Data General

Technical Reference

MODEL 6030 DISKETTE SUBSYSTEM

014-000065-01

NOTICE

Data General Corporation (DGC) has prepared this manual for use by DGC personnel and customers as a guide to the proper installation, operation, and maintenance of DGC equipment and software. The drawings and specifications contained herein are the property of DGC and shall neither be reproduced in whole or in part without DGC prior written approval nor be implied to grant any license to make, use, or sell equipment manufactured in accordance herewith.

DGC reserves the right to make changes without notice in the specifications and materials contained herein and shall not be responsible for any damages (including consequential) caused by reliance on the materials presented, including but not limited to typographical or arithmetic errors, company policy and pricing information. The information contained herein on DGC software is summary in nature. More detailed information on DGC software is available in current released publications.

NOVA, SUPERNOVA and **ECLIPSE** are registered trademarks of Data General Corporation, Westboro, Massachusetts.

014-000065-01 is the result of adding the following technical updates to Rev. 00 of the manual:

042-000019

Ordering No. 014-000065
©Data General Corporation, 1977
All Rights Reserved
Printed in the United States of America
Rev. 01, August, 1977

TABLE OF CONTENTS

SECTION I

GENERAL INFORMATION

	Page
INTRODUCTION	I-1
SPECIFICATIONS	I-2
INSTRUMENT IDENTIFICATION	I-2
SERVICE CONTRACTS	I-2
TRAINING PROGRAMS	I-2
DISKETTE CONTROLLER	I-3
DISKETTE DRIVE UNIT	I-3
Data Writing	I-3
Data Reading	I-3
REFERENCE PRINTS	I-3

SECTION II

PROGRAMMER'S REFERENCE INFORMATION

INTRODUCTION	II-2
CONTROLLER REGISTERS	II-2
INSTRUCTIONS	II-3
SPECIFY DISC ADDRESS AND SECTOR COUNT	II-3
SPECIFY COMMAND AND CYLINDER	II-4
LOAD MEMORY ADDRESS COUNTER	II-4
READ STATUS	II-4
READ DISC ADDRESS	II-5
READ MEMORY ADDRESS REGISTER	II-6

TABLE OF CONTENTS (Continued)

SECTION II (Continued)

PROGRAMMER'S REFERENCE INFORMATION

Page

PROGRAMMING II-6
- Phase I: Select the Drive, Surface, Sector and Number of Sectors II-7
- Phase II: Position the Head II-7
- Phase III: Read or Write II-8
  - Read II-8
  - Write II-9
- Program Load (Bootstrap) from Disc II-9

FORMATTING II-10

TIMING II-10

ERROR CONDITIONS II-11
- During Initial Selection II-11
- During Head Positioning II-11
- During Reading II-11
- During Writing II-12
- During a Disc Program Load II-12

SECTION III

OPERATING CONTROLS AND PROCEDURES

INTRODUCTION III-1

DISKETTE HANDLING PRECAUTIONS III-2

OPERATOR CONTROLS III-3
- Power Switch and Indicator Light III-3
- Drive Door Latch III-3
- Unit Select Switch III-3
- Status Lights III-3

OPERATING PROCEDURES III-3
- Inserting a Diskette Into the Drive III-3
- Changing a Diskette III-4
- Shutting Down a Diskette Drive III-4

FORMATTING PROCEDURE III-4

BOOTSTRAP PROCEDURE III-4
- With the Program Load Option III-4
- Without the Program Load Option III-4

TABLE OF CONTENTS (Continued)

SECTION IV
INSTALLATION

Page

INTRODUCTION IV-1

REFERENCE PRINTS IV-1

INSTALLING THE DISKETTE DRIVE UNIT IV-1
- Unpacking IV-2
- Power Requirements IV-2
- Grounding Requirements IV-2

PRELIMINARY CHECKOUT IV-3
- Installing the Drive Unit in a Cabinet IV-5

INSTALLING THE DISKETTE CONTROLLER IV-11
- Unpacking IV-11
- Choosing a Slot IV-11
- Developing Data Channel and Program Interrupt Priority Chains IV-12
- High Speed Data Channel Considerations IV-12
- Device Code Selection IV-14
- Internal Cable IV-15
- Installing the Controller in the Computer IV-15

CABLING THE DISKETTE SUBSYSTEM IV-17
- Cabling a 6030 Series Subsystem IV-17
- Cabling a 6030/4234 Series Mixed Subsystem IV-18

SYSTEM TESTING IV-18

SECTION V
MAINTENANCE

INTRODUCTION V-1

ROUTINE MAINTENANCE PROCEDURE V-1

REMOVING A DRIVE UNIT FROM ITS ENCLOSURE FOR ADJUSTMENTS AND REPAIRS V-2

APPENDIX A
TECHNICAL SPECIFICATIONS

GENERAL A-1

MECHANICAL A-1

ENVIRONMENTAL A-1

APPENDIX B
ORDERING INFORMATION

DG-01928

MODEL 6030 DISKETTE SUBSYSTEM

SECTION I
GENERAL INFORMATION

INTRODUCTION

The 6030 Series Diskette Subsystem offers random-access, moving head disc storage on low cost flexible media for Data General computers. A diskette or platter has one recording surface divided into 77 tracks, each having 8 sectors. Data is transferred to the disc subsystem from the computer memory in blocks of 256 16-bit words (512 bytes) and is transcribed to disc one data block per sector. This data format with 256 words per block allows nearly 25% more data to be stored on a single diskette than is commonly possible with other formats in use throughout the industry. Furthermore, a data block size of 256 words is common to all DGC disc equipment; having the same data block size for all disc devices simplifies data base structuring for users having different devices in the same computer system. Diskette drives may be intermixed in the same subsystem with large capacity, high-speed, disc cartridge drives, from Data General's 4234-series.

Important design features reduce head and diskette wear and improve data reliability:

- **Head Unloading**

A head control in the drive automatically unloads the head from the disc surface and leaves it positioned over the most recently accessed track whenever lapses in data transcription occur; the head controller then automatically reloads the head over the same track at the beginning of the next read or write operation. (When the next operation includes a seek to a new track, track seeking and head loading overlap to reduce the time needed to access a given sector.)

- **Hard and Soft Sector Marking**

A photosensing element near the drive spindle detects holes punched around the center of each diskette and generates precise timing signals that index a track and mark the beginning of each sector therein (hard format marks). Additionally, track and sector address of each block is prerecorded by Data General at the beginning of each sector (soft format). That address is checked and confirmed block by block by the subsystem before every data transfer. An error is signaled to the program and no data is transferred if the address read from the diskette does not match the anticipated address for the desired sector.

- **Write Compensation**

Two levels of write current compensate for the variation in relative head-to-disc speed and effective data density (BPI) as the head moves nearer to and farther from the center of the disc.

- **Write Protection**

There is a Write Protect hole pre-punched near a corner of the diskette packet. A photo-sensing circuit in a drive disables writing whenever a diskette in that drive does not have its write protect hole covered with an opaque patch. A supply of opaque tape is provided with each package of diskettes.

- **Fully Enclosed Unit**

Diskette drives are fully enclosed to reduce the likelihood that dust, tobacco smoke or other airborne contaminates from the computer room can settle on the disc, head or spindle surfaces. The entire unit mounts on slides in standard 19" wide equipment cabinets. When the unit is pulled forward on its slides, it can be easily opened for full access to all mechanical and electrical components. This simplifies periodic maintenance and repairs.

- **Simple Operation**

Diskette loading and unloading is straightforward: READY, Write Protect, TRACK 0, and Power ON indicators provide an operator with convenient information about any unit. A thumbwheel unit-select lets operators quickly assign and change the identity of each diskette unit in multiple unit subsystems.

Each diskette subsystem consists of a controller and a number of disc drives. The controller is normally purchased with the first diskette drive. It is a 15" x 15" printed circuit board that mounts in any I/O slot of a Data General computer chassis. One to four disc units may be connected to the controller, and any combination of 6030-series diskette drives and 4234-series cartridge drives may be intermixed in the same subsystem. (Alternatively, the controller may be purchased with 4234-series disc cartridge drives; in both cases, diskette and cartridge drives may be intermixed.) A subsystem installed with fewer than four drives may be easily expanded.

When data is transcribed to or from diskette units, sixteen bit data words are parallel transferred between the computer memory and the disc subsystem controller at a rate of 15,625 words per second; data is serially transferred between the subsystem controller and a diskette drive at a rate of 250,000 bits per second.

The 6030 diskette subsystems are supported by a comprehensive package of diagnostic, reliability, and formatting programs, which are supplied with each unit.

SPECIFICATIONS

Complete technial specifications of the 6030 series subsystems are included in Appendix A.

INSTRUMENT IDENTIFICATION

The model number and serial number of the drive unit are stamped on a plate attached to the rear of the chassis, above the device cable opening. The electrical specifications of the power supply are stamped on a plate attached to the power supply cover plate on the rear of the chassis. The controller's identification numbers are etched on the controller board. Always refer to all identification numbers in any correspondence with Data General concerning the equipment.

SERVICE CONTRACTS

Service contracts are available for the 6030 series diskette subsystem. For further information, contact nearest field service depot or

Data General Corporation
Field Service Department
Southboro, MA. 01772

Telephone: 617-485-9100

TRAINING PROGRAMS

A number of training courses are conducted periodically by Data General Corporation at Southboro, Massachusetts and other selected locations. Included are courses covering maintenance procedures for the 6030 series subsystem, and operation and programming of Data General computers and peripheral equipment.

For the latest scheduling information, contact

Data General Corporation
Training Department
Southboro, MA. 01772

Telephone: 617-485-9100

DISKETTE CONTROLLER

The model 6030 diskette controller consists of a fifteen inch square printed circuit board which may be installed in any device slot of a NOVA line or ECLIPSE line computer, and provides the necessary interfacing between the CPU and the diskette drives. The board contains registers, shifters and control logic necessary to address diskette sectors and computer memory, and to transfer data between the processor and the subsystem drives. Sixteen-bit data words are transferred in parallel between the computer's I/O bus and the controller, and are transferred serially between the controller and a selected drive. The controller performs the serial/parallel and parallel/serial conversions, and checks the data stream from the diskette for checkword errors. The system block diagram shows the major elements of the controller, as well as the data paths and control signals among them.

The controller is programmed using the basic I/O commands for NOVA line and ECLIPSE line computers. The programming commands serve to prepare the diskette unit for a data transfer and to initiate such a transfer. The data transfer itself takes place independently, through the data channel. Programming information for the diskette drive subsystem is included in the programmer's reference section.

DISKETTE DRIVE UNIT

The 6030 Diskette Drive Unit consists of an electromechanical drive assembly, a power supply, and a fifteen inch square printed circuit board, enclosed in a nineteen inch wide chassis. The drive assembly contains the diskette spindle, the transcription head and its carriage, and motors to run the spindle and move the head. The assembly also includes a small printed circuit board which contains the logic to operate the drive and register its status. The aggregate logic to control and transfer data to/from the diskette drive unit is divided between the large circuit board (adapter board) and the small circuit board (drive logic board). The system block diagram reflects this division, where the major functional elements used in data transfer and control are shown on separate circuit boards within the drive unit.

Two diskette drive assemblies may be mounted in a single chassis, and share the same adapter board and power supply. However, they are two distinct logical units which are effectively daisy-chained together via the adapter board.

Data Writing

A write current driver is located on the drive logic board, and amplifies signals from the data and clock stream to the transcription head to record data on the diskette in 2F encoded mode. A control signal from the adapter board automatically reduces the write current when the drive is writing to a track numbered greater than 43_{10}.

Data Reading

A read current amplifier is located on the drive logic board, and amplifies the analog signal read from the diskette. The signals are converted to digital signals and the clock stream is separated from the data stream. Both of these serial streams are transferred to the controller, where the data stream is tracked by the clock stream and transferred to the controller as two separate streams, READ SEPARATED DATA and READ CLOCK. Each block of data is checked for read/write errors as it is read. As a block of data is read from the diskette, checkword logic automatically generates a 16 bit word which is compared to a 16 bit checkword written on the diskette at the end of the data block. The checkword was generated when the data was written, and if any bit differs from the word generated during reading, the checkword error flag is set.

ORDERING INFORMATION

Model numbers and descriptive information for diskette equipment may be found in Appendix B.

REFERENCE PRINTS

The reader may refer to the following DGC engineering schematic prints for further details of the controller and drive logic:

001-000258 (9 sheets) Disc Cartridge Control

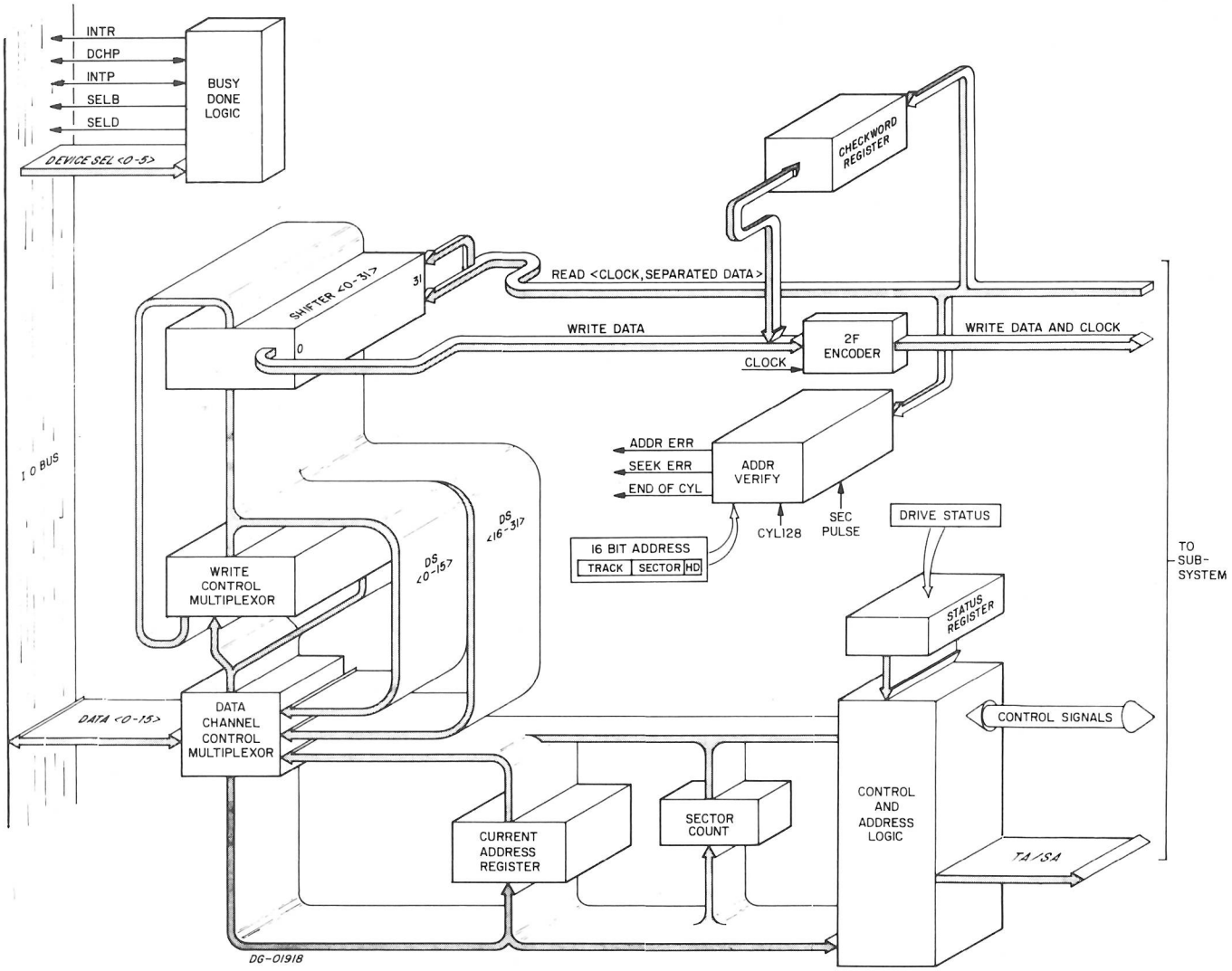
001-000797 (2 sheets) Diskette Interface (A)

001-000812 (1 sheet) Diskette Interface (B)

001-000846 (8 sheets) Flow & Timing

001-000893 (2 sheets) Diskette Timing

BLOCK DIAGRAM OF DISKETTE CONTROLLER



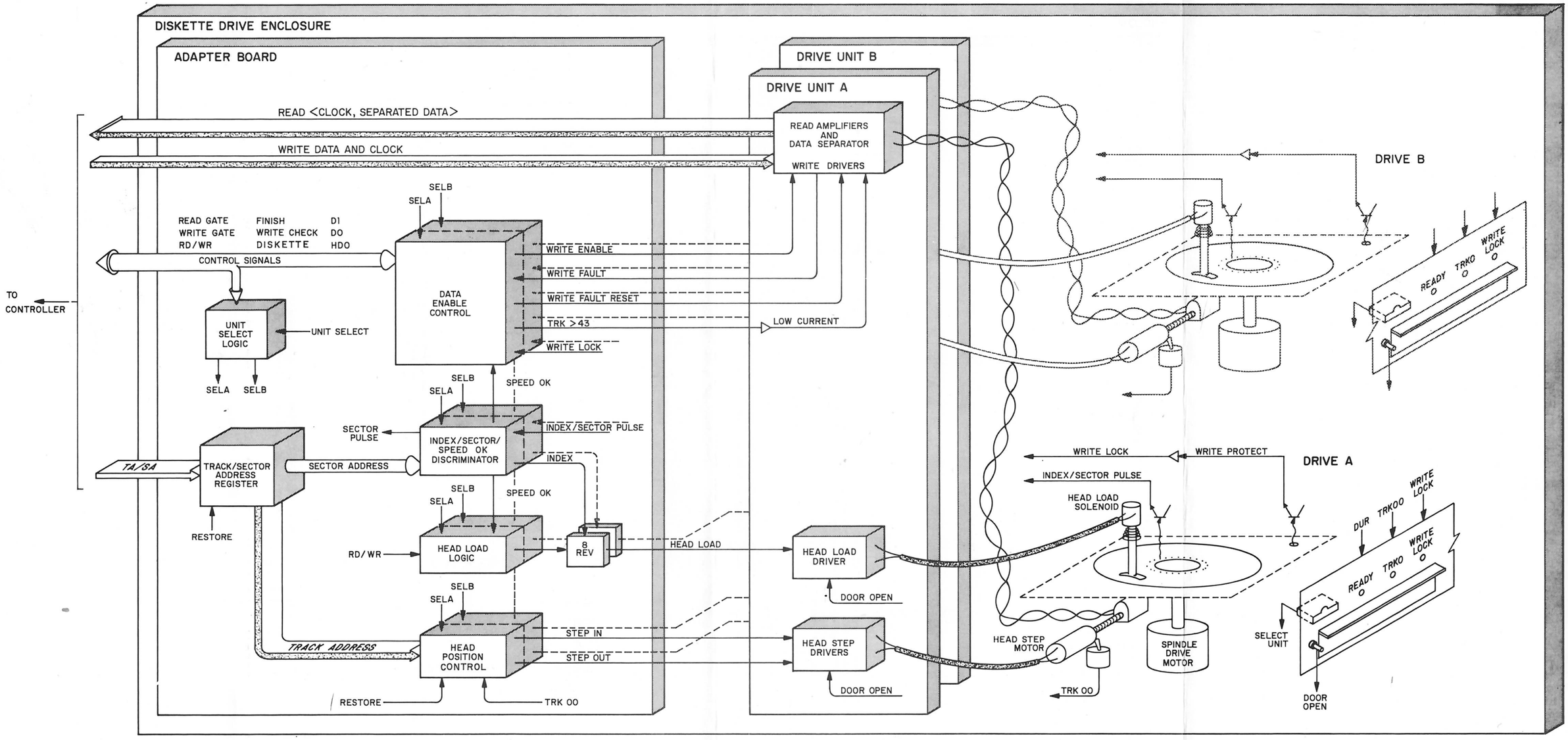
THE DISKETTE CONTROLLER provides the necessary interfacing between a Data General computer and a diskette subsystem. The control and address logic decodes instructions and sends information to the drive unit to enable reading or writing operations and to specify the address of the data blocks used in these operations. The address verify logic reads the formatted track/sector address during every data transfer, and compares that address to the one specified by the program. An error signal is sent to the program if the address is not the one specified.

During a write operation, 16 bit data words are transferred in parallel from the I/O bus to the 3:1 data channel control multiplexor. The data words are loaded through the write multiplexor into the 32-bit shift register. When two words have been assembled the shift register converts them to serial data , which is combined (in 2F encoded mode) with clock timing signals and transferred to the drive, where the serial stream is written to disc. Data is transferred in blocks of 256 words, and a 16 bit cyclic polynomial checkword is generated in the checkword register as each block is written. Immediately after the block is written to disc, the controller serially transfers the checkword to the drive to be written to disc.

During a read operation, serial data words or clock signals from the diskette, separated in the drive unit, are loaded into the controller's shift register. When two words have been assembled in the shifter, they are parallel loaded into the data channel control multiplexor one at a time, and transferred to the I/O bus. Data is transferred in blocks of 256 words, and a 16 bit cyclic polynomial checkword is generated in the checkword register as each block is read. A checkword is read from the diskette at the end of each data block, and is compared, bit by bit, with the checkword generated during the read operation. If the checkwords differ, an error signal is sent to the program.

The Busy and Done logic and the status register allow the program to determine in detail the status of the subsystem.

BLOCK DIAGRAM OF DISKETTE DRIVE UNIT



THE DISKETTE DRIVE UNITS contain basic transcription and head position control for the diskette subsystem. The track and sector address selected by the program is loaded into the track/sector address register and decoded on the adapter board. This information generates signals to the specified drive to initiate a seek operation. The head position control monitors the head position and compares it to the specified track address. If the head is not at the specified address, the control determines which direction (in or out) and the number of steps the head must move, steps the head to the specified track, and compares the address with the position. The control is calibrated by the TRACK 00 signal. Once the specified track is reached, an optical sensor on the drive and a counter on the adapter board generate hard sector marking signals to the controller, which in turn initiates reading the sector format to verify the address.

During a write operation, the serial stream of 2F encoded data from the controller is amplified by the write current drivers and recorded on the diskette at the disc address specified by the program. Write operations are selected by the data enable control on the adapter board.

During a read operation, the 2F encoded data read from the diskette is amplified and separated, by the read amplifier and data separator on the drive logic board, into two streams, READ SEPARATED DATA and READ CLOCK. The data is tracked by transferring the two streams to the controller's shift register and bit counter, respectively. Read operations are selected by the data enable control on the adapter board.

Switches and optical sensors on the drive generate control signals for sector and index identification and interlock functions, and to trigger the status lights on the front panel.

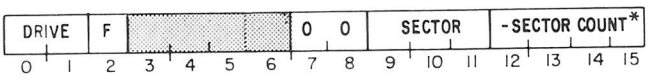
SECTION II
PROGRAMMER'S REFERENCE INFORMATION

SUMMARY

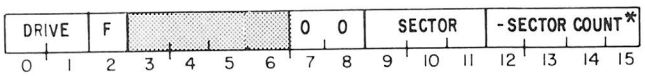
MNEMONIC (FIRST CONTROLLER) ..... DKP
DEVICE CODE (FIRST CONTROLLER)..... 33_8
MNEMONIC (SECOND CONTROLLER) ... DKP1
DEVICE CODE (SECOND CONTROLLER).... 73_8
PRIORITY MASK BIT 7
SURFACES/UNIT 1
TRACKS/SURFACE (CYLINDERS) 77
SECTORS/TRACK 8
WORDS/SECTOR 256
TOTAL STORAGE CAPACITY (WORDS) 157,696
MAXIMUM TRANSFER RATE (WORDS/SEC)..... 15,625
ALLOWABLE DATA CHANNEL LATENCY (μSEC) 128
SEEK TIME MAX/MIN (mSEC) 770/20
SECTOR ACCESS TIME MAX/MIN (mSEC)..... 166/1.2

ACCUMULATOR FORMATS

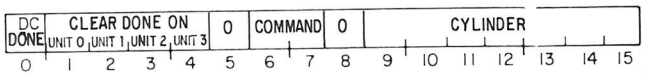
SPECIFY DISC ADDRESS AND SECTOR COUNT ..... (DOC)



READ DISC ADDRESS..... (DIC)



SPECIFY COMMAND AND CYLINDER .... (DOA)

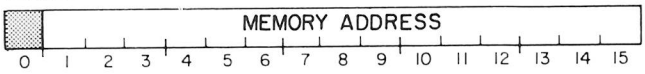


COMMANDS

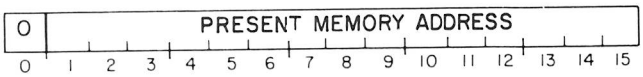
00 Read	10 Seek
01 Write	11 Recalibrate

READ STATUS ..... (DIA)

LOAD MEMORY ADDRESS REGISTER .... (DOB)



READ MEMORY ADDRESS REGISTER .....(DIB)



S, C AND P FUNCTIONS

S — Set the Busy flag to one, the Done flag to zero and start the operation specified in the Command Register.

C — Set the Busy flag to zero, the Done flag to zero and stop all data transfer operations.

P — Reset the Done flag and start the operation specified in the Command Register if that operation is a Seek or a Recalibrate.

*MAXIMUM NUMBER OF SECTORS FOR DISKETTE IS 8_{10}.

INTRODUCTION

6030 Series diskette units transcribe data on one surface of thin (0.003in), flexible, removable, magnetic discs. Each diskette unit can accept a single diskette (floppy disc). 6030-series models contain two diskette drive units in a single rack-mountable enclosure that includes an adapter; 6031-series models contain one such drive and its adapter. A total of four units may be connected together in a disc cartridge subsystem. The identity of a diskette unit (i.e., its unit number, 0-3), is operator-selectable by means of a thumb-wheel switch on the front panel of the diskette unit's enclosure.

Since there is only one recording surface on a diskette (numbered 0) each cylinder contains a single track. There are 77 cylinders, numbered $0\text{-}114_8$, and each cylinder is divided into 8 sectors, numbered 0-7. A sector can store 256 (400_8) 16-bit data words and contains a checkword which is hardware-verified whenever data is read. Data storage capacity is 2,048 words/track or cylinder and 157,696 words/diskette. Words are transferred via the data channel to and from a diskette unit in a disc subsystem at the rate of 15,625 words/sec; up to 8 consecutive sectors of data from a single track may be transferred in a single read or write operation.

The subsystem controller for a disc subsystem can direct the activities of one, two, three, or four diskette units. Any number of units may be performing Seek or Recalibration operations simultaneously, but only one unit may be reading or writing at the same time.

6030 Series diskette units and 4234 Series cartridge drives are compatible. They[1] use the same controller in their respective subsystems, and may be intermixed within one subsystem provided: a) no more than four disc units (total) are connected together, and b) no two disc units are assigned the same unit number. However, the two series disc units have different numbers of tracks, surfaces, and sectors; and their data transfer rates are different. Certain status flags denote dissimilar conditions depending on the type of unit.

A diskette unit identifies itself by setting the D flag to 1 in the subsystem status register, and causes the subsystem controller to make those adjustments necessary for controlling the diskette unit.

The instruction descriptions and programming considerations presented in this section pertain solely to the 6030 diskette units in a disc cartridge subsystem. When the subsystem also includes 4234-series cartridge drives, consult the technical reference for 4234-series disc subsystems, or the Programmer's Reference Manual for Peripherals (DGC No. 015-000021) for programming considerations pertaining to those drives.

6030 Series diskette units do not support shared CPU operation.

CONTROLLER REGISTERS

This disc drive controller contains four program accessible registers: a 15-bit Memory Address Register, a 16-bit Status Register, a 16-bit combined Command and Cylinder Select Register, and a combined Disc Address Register and Sector Counter. The Memory Address Register is self incrementing and contains the address of the next location whose contents are to be transferred to or from the disc subsystem via the data channel. The Status Register contains four Seek Done flags, a Read/Write Done flag, a Unit Ready flag and six Error flags. The Seek Done and Read/Write Done flags are able to initiate a program interrupt request when they are set to 1. The combined Command and Cylinder Select Register contains the last command issued to the subsystem and the number of the desired track on the selected unit. The combined Disc Address Register and Sector Counter contains the number of the next sector to be read or written and the two's complement of the number of sectors remaining to be read or written. The Disc Address and the Sector Counter portions of this register are incremented immediately after data is read from or written on a sector.

[1]Only 4234 Series Disc Cartridge units and 6030 Series Diskette units may be intermixed in the same subsystem.

INSTRUCTIONS

Six instructions are used to program data channel transfers to and from the subsystem. Three of these instructions are used to supply the controller with all the necessary information for any disc operation. The remaining instructions allow the program to determine, in detail, the current state of the subsystem.

In the descriptions of the separate instructions the general form of how the instruction is coded in assembly language is given along with the instruction format and the description of the instruction. The general form of how an instruction may be coded has the following format:

MNEMONIC<optional mnemonic> ac, DKP

The mnemonic must be coded exactly as shown in the instruction description. The optional mnemonic may be appended to the main mnemonic if the option is desired.

The symbols <> and = are used in this section to aid in defining the instructions. These symbols are not coded; they act only to indicate how an assembly language instruction may be written. Their general definition is given below.

<> Indicates optional operands. The operand enclosed in the brackets (e.g., <f> may be coded or not, depending on whether or not the associated option is desired.

= Indicates specific substitution is required. Substitute the desired accumulator or mnemonic.

The following abbreviations are used throughout this section.

AC or ac	Accumulator
F or f	Flag control function

The disc controller's Busy and Done flags are controlled using all three of the device flag commands as follows:

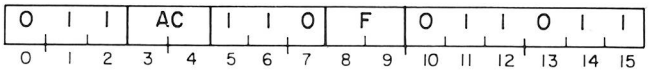
f=S Set the Busy flag to 1, set the Done flag to 0, set the Address Error, End of Cylinder, Checkword Error, Data Late, and Unsafe flags to 0, and initiate the operation specified by the contents of the Command Register.

f=C Set the Busy flag to 0, set the Done flag to 0, set all error flags to 0 and stop all data transfer operations.

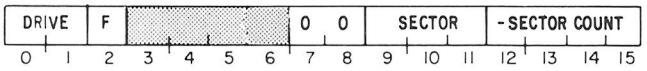
f=P Set the Done flag to 0, set all error flags to 0 and initiate the operation specified by the contents of the Command Register.

SPECIFY DISC ADDRESS AND SECTOR COUNT

DOC<f> ac, DKP



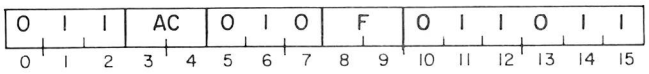
Bits 0-15 of the specified AC are loaded into the controller's Disc Address Register and Sector Counter. After the data transfer, the controller's Busy and Done flags are set according to the function specified by F. The contents of the specified AC remain unchanged. The format of the specified AC is as follows:



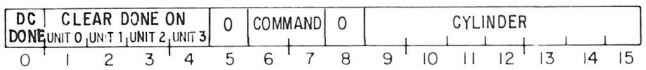
Bits	Name	Function
0-1	Drive	Select the drive $0\text{-}3_8$.
2	FORMAT	If 1, place controller in FORMAT mode.
3-6	---	Reserved for future use.
7-8	---	Must be set to zero.
9-11	Sector	Select starting sector $0\text{-}7_8$ for start of a Read or Write operation.
12-15	Sector Count	Specify the two's complement of the number of sectors to be read or written in one operation (maximum of 8_{10}). (Bit 12 must be set to 1.)

SPECIFY COMMAND AND CYLINDER

DOA<f> ac,DKP



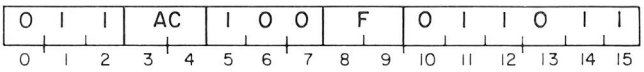
Bits 0-15 of the specified AC are loaded into the controller's combined Command/Cylinder Select Register. After the data transfer, the controller's Busy and Done flags are set according to the function specified by F. The contents of the specified AC remain unchanged. The format of the specified AC is as follows:



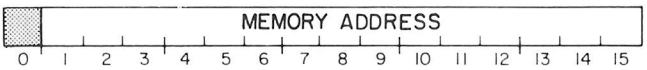
Bits	Name	Function
0	Clear DC Done	Set the controller's Done flag to 0; set the following indicating flags to 0: Address Error, Checkword Error, End of Cylinder, and Unsafe.
1-4	Clear Seek Done	Set the Seek Done flags to 0 for the drives 0-3, respectively.
5	---	Must be set to 0.
6-7	Command	Specify the command for the selected drive as follows: 00 Read 01 Write 10 Seek 11 Recalibrate
	---	Must be set to 0.
9-15	Cylinder	Specify the desired cylinder ($0\text{-}114_8$) for a Seek, Read or Write operation.

LOAD MEMORY ADDRESS COUNTER

DOB<f> ac,DKP



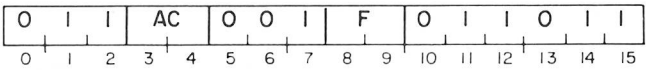
Bits 1-15 of the specified AC are loaded into the controller's Memory Address Counter. After the data transfer, the controller's Busy and Done flags are set according to the function specified by F. The contents of the specified AC remain unchanged. The format of the specified AC is as follows:



Bits	Name	Function
1-15	--- Memory Address	Reserved for future use. Location of the next word in memory to be used for a data channel transfer.

READ STATUS

DIA<f> ac,DKP



The contents of the Status Register are placed in bits 0-15 of the specified AC. After the data transfer, the controller's Busy and Done flags are set according to the function specified by F. The format of the specified AC is as follows:

The meaning at each status flag is shown in the following table.

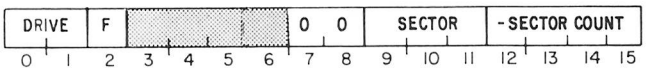
READ STATUS (Continued)

Bits	Name	Meaning When 1
0	DC Done	The subsystem has completed a Read or a Write operation.
1-4	Seek Done	Drive 0-3, respectively, has completed a Seek or Recalibrate operation. More than one of these bits can be set at any time.
5	Diskette	Indicates that selected unit is a diskette unit.
6-7	---	Reserved for future use.
8	Unsafe	The selected drive is in an unsafe condition. The Unsafe flag can be reset with a CLR, IOPLS, IORST, or STRT.
9	Unit Ready	The selected drive is not performing any head movements and is ready to carry out a command (Read, Write, or another Seek).
10	Seek Error	The selected drive was not able to carry out a Seek or Recalibrate operation issued.
11	End of Cylinder	The selected drive attempted to continue a Read or Write operation beyond the 8th sector of any track.
12	Address Error	The address read from the address field at the beginning of a sector does not match the last address specified to the disc controller.
13	Checkword Error	The checkword read from the disc at the end of a sector does not match the checkword calculated by the controller.
14	Data Late	The data channel failed to respond in time to a data channel request.
15	Error	One or more of the bits 8, 10, 11, 12, 13, or 14 in the Status Register is set to 1.

READ DISC ADDRESS

DIC<f> ac,DKP

The contents of the Disc Address Register and the Sector Counter are placed in bits 0-15 of the specified AC. After the data transfer, the controller's Busy and Done flags are set according to the function specified by F. The format of the specified AC is as follows:

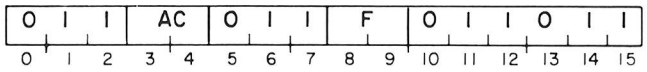


Bits	Name	Contents
0-1	Drive	Number of the selected drive.
2	FORMAT	Indicates that the controller is in FORMAT mode.
3-6	---	Reserved for future use.*
7-8	---	Must be set to 0. Note: An end of cylinder error will set bit 7 to 1.
9-11	Sector	The number of the sector immediately following the last sector read or written.
12-15	-Sector Count	The two's complement of the number of sectors remaining to be read or written.

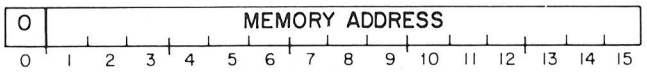
*Bits 3-6 are the high-order bits for the head address and are ignored in all operations. If these bits are loaded with a value during a DOC instruction, this loaded value will appear in the specified accumulator when a DIC instruction is issued. See Phase I of Programming.

READ MEMORY ADDRESS REGISTER

DIB<f> ac, DKP



The contents of the Memory Address Register are placed in bits 1-15 of the specified AC. Bit 0 is set to 0. After the data transfer, the controller's Busy and Done flags are set according to the function specified by F. When the Memory Address Register is read after a Write operation, the contents point to a memory location two greater than the location of the most recent word written on the disc. The format of the specified AC is as follows:



Bits	Name	Contents
0	---	Reserved for future use.
1-15	Memory Address	Location of the next word in memory to be used for a data channel transfer.

PROGRAMMING

The preparation of a 6030 Series diskette subsystem for data channel transfers is divided into three phases: I, selecting the drive, the surface and the sector; II, positioning the head over the correct cylinder; and III, starting the Read or the Write operation. The results of issuing commands in each phase should be checked for errors before proceeding to the next phase.

The flowcharts accompanying the text illustrate the order in which the commands may be performed when programming each phase. These simplified flowcharts assume the following conditions:

1. Only one disc unit is in use.
2. The computer is dedicated to the disc subsystem; i. e., the Interrupt On flag is set to 0.

The principles illustrated here can be extended by the programmer to cover multiple drivers and interrupt driven disc handling routines.

The read and the write entry counters appearing in the flowcharts are used to count the number of times the program attempts to perform any specific operation. If the program does not succeed in completing that operation in a reasonable number of attempts (X), there may be a faulty sector or sectors on the diskette (i. e., formatting failure or surface imperfection on the diskette), or the diskette may be write protected (the write enabling hole must be covered with opaque material to allow data writing to diskette).

When the phrase "a program interrupt request is initiated" is used, a program interrupt will actually occur only when the following conditions are met:

1. The diskette subsystem is not masked out - i. e., its Interrupt Disable flag is set to 0; and
2. Interrupts are enabled at the CPU - i. e., the Interrupt On flag (ION) is set to 1.

Phase I: Select the Drive, Surface, Sector and Number of Sectors

The initial selection of a disc drive is performed as follows: a SPECIFY DISC ADDRESS AND SECTOR COUNT instruction (DOC) is issued to the controller to select the drive, the first sector to be read or written, and the two's complement of the number of sectors to be transferred in the operation. The drives are numbered 0-3, the sectors are numbered $0\text{-}7_8$; the maximum number of sectors which can be transferred in one operation is 8_{10}. Care should be taken to ensure that the parameters specified in this initial selection do not exceed the capacity of the drive unit.

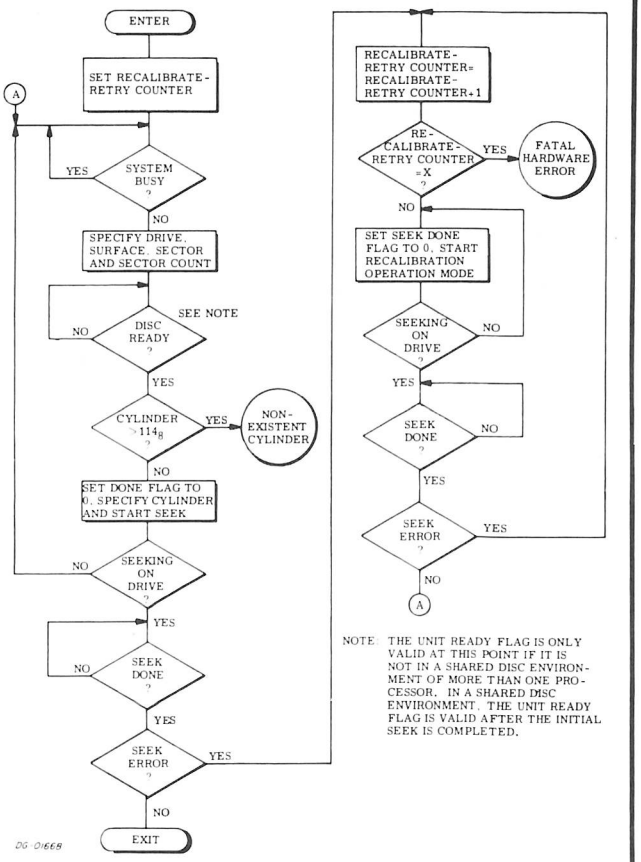
Once the drive unit is chosen, the status of that drive must be checked to determine if the drive is ready to perform another operation. When diskette units are intermixed with 4234 Series cartridge units in the same subsystem, the D flag should always be verified before initiating any diskette operations. If the D and Ready flags are 1, the program can proceed to Phase II; otherwise the program should not issue any commands to that drive unit.

Phase II: Position the Head

The head is positioned over the desired cylinder by a SPECIFY COMMAND CYLINDER instruction (DOA) issued to the controller. The accumulator specified by this instruction should contain the number of the cylinder desired and the Seek command, and should set both the DC Done flag and the Seek Done flag for the selected drive to 0. The Seek operation is initiated by the P control function. While the drive is seeking, the Unit Ready flag for that drive is set to 0. When the head has finished moving to the specified cylinder, the Unit Ready and the Seek Done flags for that drive are set to 1, and a program interrupt request is initiated.

The program should then check the Status Register to determine if a Seek error or unsafe condition has occurred. If no error has occurred, the program can proceed to Phase III.

INITIAL SELECTION AND HEAD POSITIONING



The Recalibrate operation moves the heads of the selected drive unit to cylinder 0. A Recalibrate operation is performed by a SPECIFY COMMAND AND CYLINDER instruction (DOA). The accumulator specified by this instruction should contain the Recalibrate command and should also set both the DC Done flag and the Seek Done flag for the selected drive unit to 0. The operation is initiated by the P control function. While the drive is being recalibrated the Unit Ready flag for the selected drive is set to 0. Once the Recalibrate operation is completed, the Unit Ready flag is set to 1, the Seek Done flag for the selected drive is set to 1 and a program interrupt request is initiated.

After the program initiates a Seek or Recalibrate operation in a drive unit, the controller is free to accept commands to the other drive units it controls.

If the program is simultaneously managing several drives with one controller, the error indicating flags in the Status Register apply only to the most recently selected drive unit, i.e., the unit specified in the last SPECIFY DISC ADDRESS AND SECTOR COUNT instruction issued. While one or more drive units are performing Seek or Recalibrate operations, any one of the other drive units can perform a Read or Write operation.

Phase III: Read or Write

When a drive unit is not performing a Seek or Recalibrate operation, a Read or Write operation may be initiated for that drive. A Read operation transfers blocks of data stored in the disc subsystem to the computer's memory via the data channel. A block of data contains 256 16-bit words. Up to 8 blocks can be transferred in one Read operation. A Write operation transfers blocks of data from the computer's memory via the data channel and stores the data in the disc subsystem. Again, up to 8 blocks of data may be transferred in one operation. Read and Write operations are performed in a series of steps which are nearly identical. The parameters of the data transfer must be specified and then the operation is initiated.

Read

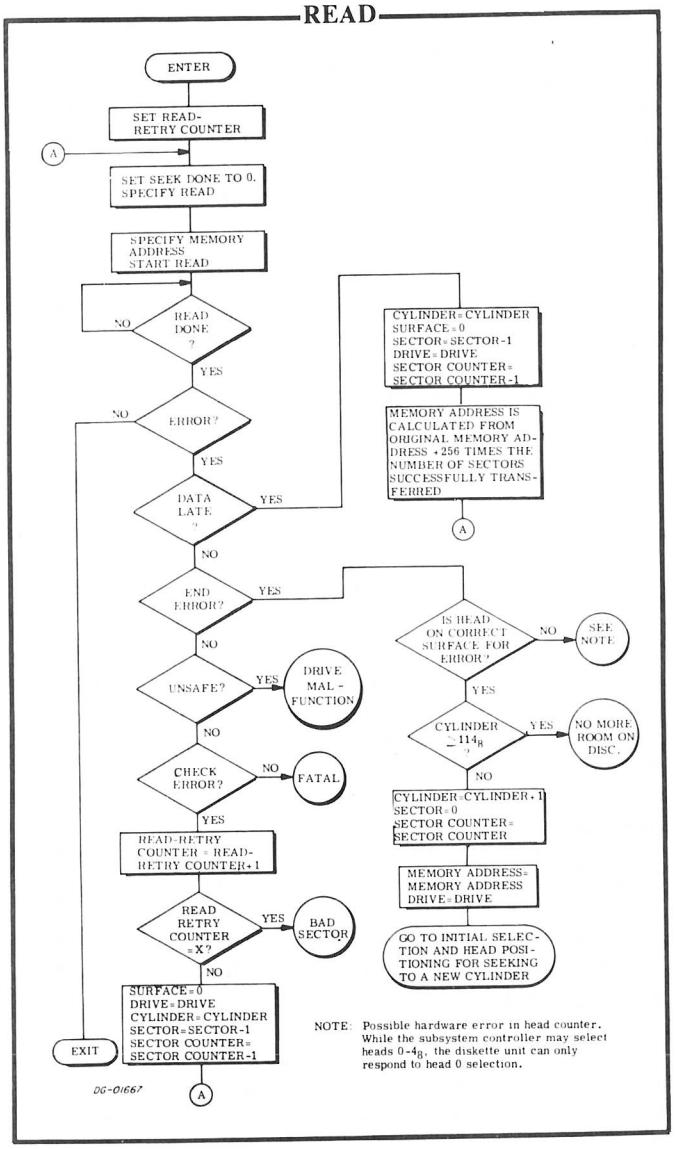
A LOAD MEMORY ADDRESS REGISTER instruction (DOB) specifies the address of the location in memory to which the first word read from the disc is transferred.

The Read command is loaded into the Command Register with a SPECIFY COMMAND AND CYLINDER instruction (DOA). The cylinder number must also be specified since it is used in the address check which is automatically made before each 256 word sector is read. The Read operation is ordinarily initiated with a Start command so that the Busy flag is set to 1 and the Done flag is set to 0.

Once the Read operation is initiated, the drive waits until the desired sector passes under the head and performs an address check. If the address read is correct, the drive then starts reading the sequential bits of the first word of the sector. When two words are fully assembled in the controller's serial to parallel buffer register, the controller transfers the words one at a time to the computer's memory via the data channel. Each time a word is transferred to memory, the Memory Address Counter is automatically incremented.

When the 256 words from the sector have been read, and the checkword at the end of the sector verified, the sector counter is automatically incremented by one.

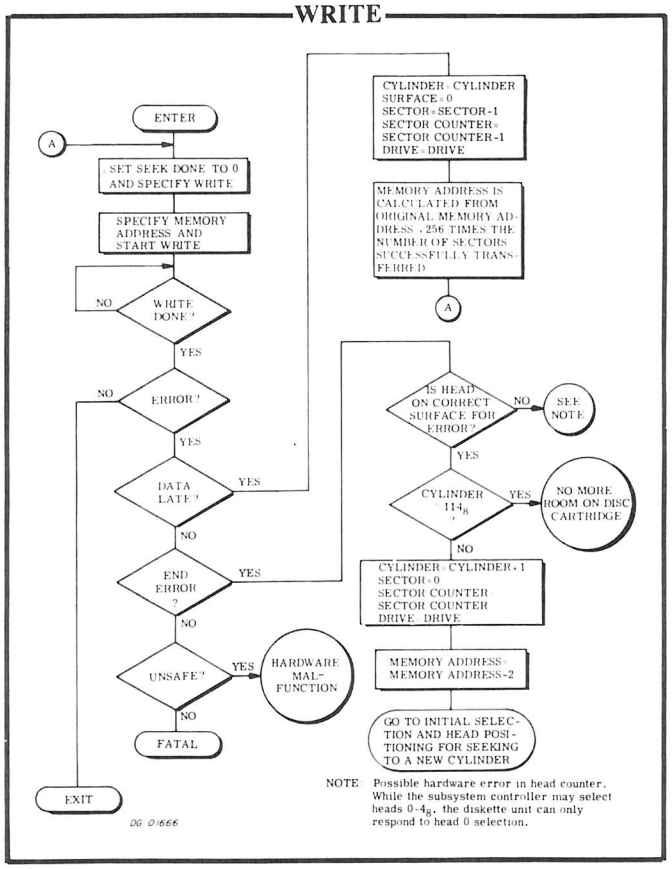
If the sector counter does not overflow, the next sector is read. This process of reading sectors continues until either the sector counter overflows or the last sector of the selected cylinder is read. Upon completion of the Read operation, the Busy flag is set to 0, the Done flag is set to 1, and a program interrupt request is initiated.



Write

A Write operation is performed as follows: A LOAD MEMORY ADDRESS REGISTER instruction (DOB) specifies the address of the location in memory from which the first word is to be written on the disc. The number of sectors to be written and the number of the starting sector were specified in Phase I.

The Write command is loaded into the Command Register with a SPECIFY COMMAND AND CYLINDER instruction (DOA). The cylinder number must be specified in this instruction since it is used in the address check which is automatically made before each 256 word sector is written. The Write operation must be initiated with a Start command so that the Busy flag is set to 1 and the Done flag is set to 0.



Once the Write operation is initiated, the controller reads two words from the computer's memory via the data channel and then waits for the desired sector to pass under the head. Each time the controller reads a word from the computer's memory, the Memory Address Counter is automatically incremented. Once the desired sector is encountered, the address check is performed automatically. If the address read from the disc is correct, the bits of each word are sequentially written. When the 256 words in the sector have been written, the controller writes the checkword it calculated from the data written in that sector on the disc. The sector counter is automatically incremented by one.

If the sector counter does not overflow, the next sector is written. This process continues until either the sector counter overflows or the last sector of the cylinder is written.

The Write operation then continues until the sector counter indicates, by overflowing, that the specified number of sectors have been written. Upon completion of the Write operation, the Busy flag is set to 0, the Done flag is set to 1 and a program interrupt is initiated.

Program Load (Bootstrap) from Disc

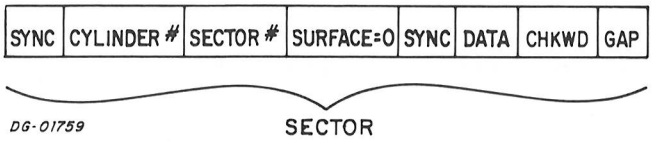
A diskette drive assigned unit number 0 may be a bootstrap device using the Program Load Option of DGC computers. To do so, the head must be positioned over track 0 and the computer must be Reset. The operator's procedure is described in section III.

Pressing the Program Load switch loads a short program, usually from a special ROM in the processor, which initiates a read operation from the first sector in track 0. Unless the read operation is terminated by the program, reading continues until 8 sectors from track 0 have been transferred from diskette.

FORMATTING

The data recording surfaces used in the 6030 Series Diskette subsystem must be formatted because the sector address is checked by the controller before the sector is read or written. If the disc is not formatted, an Address Error occurs and terminates any Read or Write operation.

A formatting program is available and is used to write the necessary sector address into the region which precedes the data field of each sector. The sector address is an information field at the beginning of every sector which defines the sector's location on the recording surface. It contains sixteen 16-bit words. The first 22 words, all containing zeros, and a 23rd word containing 000001_8, form a synchronization field. The 24th word is the address word containing the cylinder, sector, and surface numbers. The sector address is immediately followed by another synchronization field with a sync bit, a 256-word data field, and a checkword. Words containing all zeros fill the remainder of the sector to produce a gap, as shown below:



If the status register repeatedly indicates address errors, from a specified drive unit, the failing sectors or the entire data recording surfaces on the drive may need reformatting; however, when a sector is reformatted, all data in it is lost.

The program is the Disc Cartridge Formatter Program, #096-000300 (Paper Tape #095-000300).

TIMING

The diskette rotates at a speed of 360rpm; a complete revolution requires 166 milliseconds. A register in the drive unit circuitry continually provides to the controller the number of the sector currently passing under the head. This feature allows the subsystem to carry out a Read or a Write operation the first time the desired sector passes under the head.

Sector access time is a function of how far the disc must rotate to bring the desired sector under the head (rotational latency), and also includes the time needed to read and verify the sector address. The sector access time is increased if the head must load at the beginning of the read or write operation. (The diskette subsystem unloads the head of any drive where no seek, read or write operation takes place for 1.3s.) Maximum rotational latency is 166ms. Sector address checking requires 1.2ms; therefore, minimum access time (head loaded) is 1.2ms, maximum access time is 167.2ms, and the average access time is 84.2ms. When the head is unloaded, maximum access time increases to 228ms, the average is then 114.6ms.

The time required to position the head over a new track (seek time) is distance-dependent. The head moves at constant speed, requiring 10ms to move from one track to the next, and 10ms settling time is required at the end of each seek operation. Therefore the minimum seek time (seek to adjacent track) is 20ms, the maximum seek time (76 tracks) is 770ms.

Any time a Seek or Recalibrate operation is initiated by a P control function command, the controller requires 50 microseconds to respond to the command. Therefore, the program must wait 50 microseconds after initiating a head movement operation before any other disc command can be issued.

A sector passes under a head in 20.8 milliseconds while the data block in the sector passes under the head in 16.4 milliseconds. A data channel request occurs every two words or 128 microseconds. This corresponds to a data transfer rate of 15,625 words/second. Since the controller has a two word buffer, the maximum allowable data channel latency is 128 microseconds. If the data channel does not respond within this time, both the Data Late and the Error flags are set to 1. Once this error occurs, the processing of the current sector is completed and the command is terminated, even if the operation was scheduled to transfer additional sectors. The Busy flag is set to 0, the Done flag is set to 1, and a program interrupt request is initiated.

ERROR CONDITIONS

During Initial Selection

If the Unsafe flag is 1, the diskette drive has a write fault condition. While this typically indicates that the diskette in the unit is write protected (i.e., its Write Protect hole is open), the fault can also be caused by an unsafe condition in the drive's write circuits (illegal head selection, drive not ready, head not loaded, etc.). The Unsafe flag in the controller may be set to zero by issuing a CLR, IOPLS, IORST, or STRT, but the Unsafe condition may not be corrected. (For example, issuing a CLR command cannot alter the "write protection" of a diskette, the diskette must be removed from the drive and the write protect hole must be covered with opaque tape before the controller will write data to that diskette.)

During Head Positioning

If the program issues a SPECIFY COMMAND AND CYLINDER instruction (DOA) which specifies a non-existent cylinder (i.e., $>114_8$) and then places the drive unit in the Seek mode, the Seek operation is terminated. Both the Seek Error and the Seek Done flags for that unit are set to 1. When the Seek Done flag is set to 1, a program interrupt request is initiated. If any Seek operation to a valid cylinder number results in a Seek Error, the drive unit should be recalibrated. The program should not specify a non-existent sector in this instruction even though sector verification is typically done by the subsystem during Phase III, Reading or Writing.

During Reading

An error can occur in a multisector transfer when the controller attempts to read past sector 7_8 in any cylinder. When this happens, both the Error and the End of Cylinder Error flags are set to 1, the sector counter is incremented, the sector address is set to 0 and the head address is incremented to 1, an illegal head address. Finally, the Busy flag is set to 0, the Done flag is set to 1 and a program interrupt request is initiated.

Specifying a non-existent sector (i.e., $>7_8$) will cause the controller to reset the present Sector Register to zero and increment the head address to 1 (i.e., bit 7 in the Combined Disc Address Register and Sector Counter). This is an illegal head address for diskette, so the End of Cylinder Error flag will be set to 1 in the subsystem Status Register.

Each sector on a diskette is preceded by an address field. If the address read before any sector does not match the contents of the disc address registers at that time, both the Error and the Address Error flags are set to 1. The Busy flag is set to 0, the Done flag is set to 1, and a program interrupt request is initiated.

If the checkword read at the end of a sector differs from that calculated by the controller, both the Error and the Checkword Error flags are set to 1. The Read operation is terminated, even if more sectors are to be read. The Busy flag is set to 0, the Done flag is set to 1, and a program interrupt request is initiated. The Checkword Error flag indicates that at least one word in the last sector read contains an error.

If the data channel does not respond in time to a data channel request, both the Error and the Data Late flags are set to 1. The reading of the current sector continues, but once that sector has been read, the Read operation is terminated. The Busy flag is set to 0, the Done flag is set to 1 and a program interrupt request is initiated. The Data Late flag indicates that at least one word from the last sector read was not correctly transferred to memory.

During Writing

An error can occur in a multisector transfer when the controller attempts to read past sector 7_8 in any cylinder. When this happens, both the Error and the End of Cylinder flags are set to 1, the sector counter is incremented, the sector address is set to sector 0 and the head address is incremented to 1, an illegal head address. Finally, the Busy flag is set to 0, the Done flag is set to 1 and a program interrupt request is initiated.

Specifying a non-existent sector (i.e., $>7_8$) will cause the controller to reset the present Sector Register to zero and increment the head address to 1 (i.e., bit 7 in the Combined Disc Address Register and Sector Counter). This is an illegal head address for diskettes, so the End of Cylinder Error flag will be set to 1 in the subsystem Status Register.

Each sector on a diskette is preceded by an address field. If the address read before any sector does not match the contents of the disc address registers at that time, both the Error and the Address Error flags are set to 1. The Busy flag is set to 0, the Done flag is set to 1 and a program interrupt request is initiated.

If the data channel does not respond in time to a data channel request, both the Error and the Data Late flags are set to 1. The writing of the current sector continues, but once that sector has been written, the Write operation is terminated. The Busy flag is set to 0, the Done flag is set to 1 and a program interrupt request is initiated. The Data Late flag indicates at least one word in the sector was not written properly.

During a Disc Program Load

If a bootstrap load program does not terminate the read operation initiated by PROGRAM LOADING from a diskette drive, reading continues until eight sectors are transferred. After the eighth sector is transferred, the End of Cylinder flag and the Error flag will be set to 1 in the subsystem status register; bit 7 of the Combined Disc Address and Sector Counter will be set to 1, an illegal address.

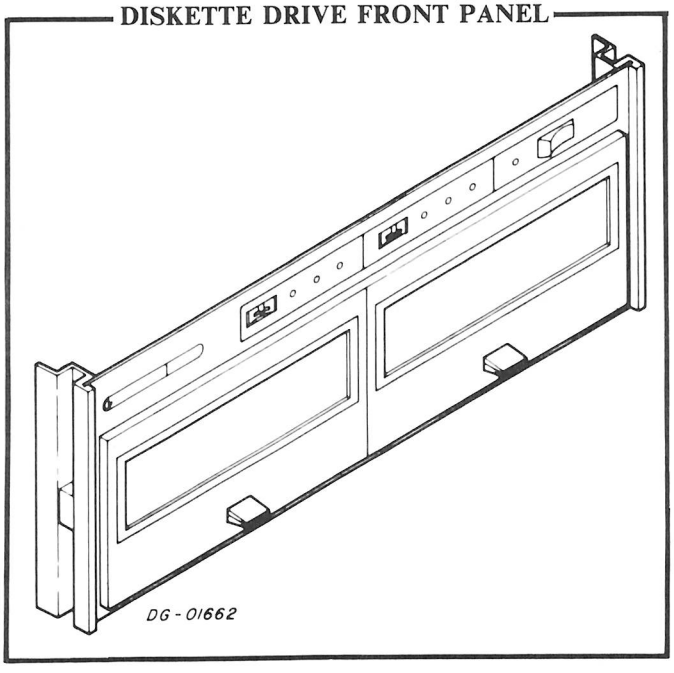
SECTION III
OPERATING CONTROLS AND PROCEDURES

INTRODUCTION

This section describes all diskette drive operator controls and the procedures required to operate the drive. A brief description of the unit and diskette is included to familiarize the operator with diskette operation.

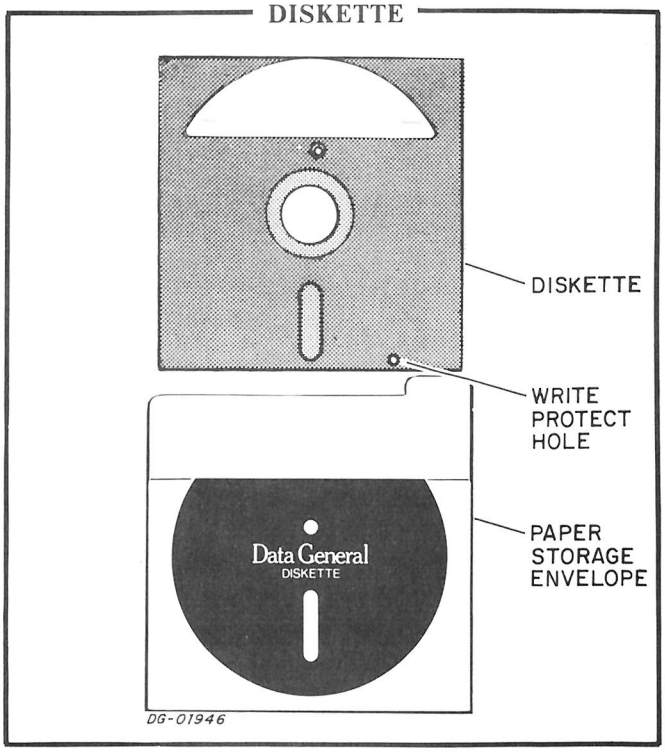
Data General's diskette drive unit, consists of an enclosure containing one or two diskette drives, which may be mounted in a standard equipment cabinet. All controls are located on the enclosure's front panel, illustrated below. The power switch is common to both drives in the enclosure. Each drive has its own unit select switch, status lights, and diskette access door.

DISKETTE DRIVE FRONT PANEL



A diskette, with its paper storage envelope, is shown in the illustration below. The recording medium is one surface of a small magnetic disc (diskette), which is sealed in a protective packet. The illustration shows that certain areas of the diskette are exposed through openings in the packet. When the drive is operating, the diskette rotates within the packet, which remains stationary in the drive. The recording surface is exposed at the Read/Write opening, where the transcription head contacts the diskette. A Write Protect hole near the edge of the packet is used to disable the drive from writing data to the diskette. A label may be attached to the packet so that information (file number, data stored) can be noted for operator convenience. Attach this label ONLY at the location indicated in the figure; this position is used to properly orient the diskette packet when it is inserted in the drive.

DISKETTE



DISKETTE HANDLING PRECAUTIONS

The diskette is sealed in a protective packet and must NEVER be removed from this packet. Do not touch the sections of the diskette which are exposed at the various openings in the packet. In addition, it is good practice to handle the packet only at the edges, to preserve the recording surface. Never bend or fold a diskette. Always store a diskette in its paper storage envelope and in a clean, dry environment; contamination of the recording surface is the primary cause of data loss. The environmental tolerances are listed in Appendix A.

Do NOT write on the identification label with an instrument, such as a lead or grease pencil, which may deposit flakes or other debris on the diskette. Data General recommends using a felt-tip marker to note information on the label. It is good practice to write on the label BEFORE attaching it to the envelope.

The information stored on the diskette may be altered or destroyed if the media is exposed to a strong magnetic field, such as one near an induction motor, a toy magnet, a bulk tape eraser, or a metal detector. Keep all diskettes, including those with no data recorded, away from strong magnetic fields. Data General supplies pre-formatted diskettes, and the format may be altered or destroyed by the magnetic field. Diskettes containing valuable data should be packed in a metal container when they are transported, to shield them from stray magnetic fields.

OPERATOR CONTROLS

Power Switch and Indicator Light

A two position rocker switch is located at the upper right-hand corner of the front panel. This switch turns power on or off to the diskette drives in the enclosure. a POWER ON indicator light is located next to the switch, and operation is as follows:

Switch Position	Drive Status
ON	The power supply and the drive motors are turned on. The POWER ON indicator light glows.
OFF	The power supply and drive motors are off. The POWER ON indicator light is off.

Drive Door Latch

A door latch tab is located under each diskette drive door. The door will open when the latch tab is pressed down. Close the door and it will automatically latch shut.

Unit Select Switch

A four position thumbwheel switch is located above each diskette drive. The four positions are labeled 0 through 3 and designate the logical unit number for the drive. Do NOT change the switch setting when the READY light is glowing; the READY light indicates that the drive is operating online with the computer. Data on any or all diskettes in the subsystem may be lost if the unit select switch is changed at this time. It is good practice to change the unit number only when the drive door is open and/or the drive power is off. Never assign the same unit number to more than one drive.

Status Lights

Three indicator lights are located above each diskette drive, and provide certain status information for operator convenience. From left to right, they are labeled READY, TRACK 0, and WRITE LOCK. The significance of each light is as follows:

Status Light	Meaning When Glowing
READY	The drive is not executing a seek command and is ready to receive an instruction
TRACK 0	The read/write head is positioned at track 0.
WRITE LOCK	The diskette in the drive is write protected.

OPERATING PROCEDURES

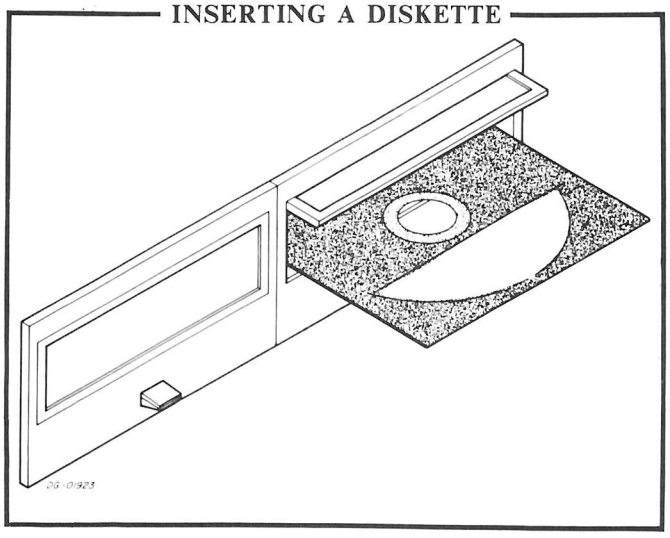
Inserting a Diskette Into the Drive

To insert a diskette into the drive unit and to prepare the unit for online operation with the computer, perform the following steps:

1. Turn the power switch to ON. (The POWER ON indicator will glow.)
2. Select the logical unit number with the thumbwheel switch.
3. Remove a diskette from its paper storage envelope. If data is to be written to the diskette, cover the "Write Protect" hole with a piece of opaque tape. Wrap the tape over the edge so that both sides of the hole are covered. A supply of tape is included with all diskettes.

   If the diskette is to be write protected, ensure that the hole is exposed.
4. Open the drive door by depressing the latch tab below the door.
5. Slide the diskette into the drive with the label on the envelope facing up and out as shown. The diskette should slide in smoothly and will come to a positive stop in the drive.

INSERTING A DISKETTE



6. Close the drive door so that it latches shut. The READY and TRACK 0 light will glow. If the media is write protected the WRITE LOCK light will glow.

The diskette drive is now ready to accept and execute commands. The read/write head is unloaded and is positioned at track 0.

Changing a Diskette

To change a diskette, perform the following steps:

1. Ensure that the READY light is glowing.
2. Open the drive door by depressing the latch tab below the door.
3. Slide the diskette out of the drive and place it in its paper storage envelope.
4. Remove the new diskette from its paper storage envelope. Attach or remove the "write protect" tape as desired.
5. Repeat steps 5 and 6 above.

Shutting Down a Diskette Drive

To shut down the diskette subsystem, perform the following steps:

1. Remove the diskette from the drive.
2. Turn the power switch to OFF. (The POWER ON light will go out.)

FORMATTING PROCEDURE

A paper tape, #095-000300, is available from Data General to write the sector format on a diskette, without the assistance of a disc operating system in the computer system. The program listing, #096-000300, contains operating instructions to properly format a diskette. Two types of formatting procedures are listed: one which formats all tracks and sectors on the diskette, and one which formats selected tracks.

BOOTSTRAP PROCEDURE

This section describes the operator procedures necessary to load a "bootstrap loader" into the computer memory from a diskette subsystem. It is assumed that the operator has a diskette with a bootstrap loader recorded on it. This short program will be read into memory and it will read user programs into memory for subsequent execution.

There are two procedures used to bootstrap the subsystem; one is used when the computer has the program load option, and one is used when the computer does not have the program load option. These are described separately below.

With the Program Load Option

When the Data General computer is equipped with the program load option, perform the following steps to bootstrap the diskette subsystem:

1. Turn power on to both the diskette drive and the computer controlling the subsystem.
2. Insert a diskette, with a bootstrap loader recorded, into the diskette drive assigned logical unit 0.
3. Initialize the diskette drive so that the transcription head is at track 0, and will read sector 0. The recalibration may be performed by opening the drive door and then closing it.

   Check that the READY and TRACK 0 lights are glowing.
4. Enter the subsystem device code in console data switches 10 through 15.
5. Press RESET.
6. Set console switch 0 to 1.
7. Press PROGRAM LOAD.

Without the Program Load Option

When the Data General computer is not equipped with the program load option, perform the following steps to bootstrap the diskette subsystem:

1. Perform steps 1, 2 and 3 of the above procedure.
2. Press RESET.
3. Deposit $0601XX_8$ in memory location 00376_8, using the console switches. XX is the subsystem device code, 33_8 or 73_8.
4. Deposit 000377_8 in memory location 000377_8, using the console switches.
5. Start the program at memory location 000376_8.

SECTION IV
INSTALLATION

INTRODUCTION

A 6030 series diskette subsystem may be shipped in one of three ways:

1. The diskette equipment is purchased together with a Data General computer and other equipment, forming a complete computer system, and is installed, packed and shipped in equipment cabinets.
2. The diskette subsystem is purchased as a complete subsystem to be added to an existing computer system.
3. A diskette drive unit is purchased to add on to an existing diskette subsystem.

In the first case, the complete computer system will be tested at the factory before shipment. Its onsite installation consists of selecting a site for the cabinets, unpacking them, placing them in position and verifying proper performance by running the reliability program(s). Be sure to remove the shipping bracket at the right rear of the diskette chassis.

In the second and third cases, however, the on-site installation of the diskette equipment includes a number of steps, ranging from straightforward tasks such as rack mounting the chassis and cabling the system to the more subtle task of assigning priorities at the hardware level.

This section details the on-site installation of a diskette subsystem into an existing computer system. When an existing diskette subsystem is to be expanded by adding more diskette drives, not all of the steps are required; the system configuration dictates which steps are applicable. Some of the sections, such as Computer Slot Selection, are meant only as a guide. The final choice will be unique to each computer system.

REFERENCE PRINTS

The following DGC installation drawing may be consulted as an aid to installing the drive units:

010-000064 Rack Mounting the 6030 Drive Unit

INSTALLING THE DISKETTE DRIVE UNIT

A diskette subsystem is shipped in three packages. The diskette drive unit, with its mounting hardware, is packed and shipped in a cardboard shipping container. Device cables are packed and shipped in a separate container, and all documentation is shipped in a packing envelope. Upon receipt, examine the containers for any signs of damage incurred during shipment.

NOTE Do NOT unpack cartons with any signs of damage unless specifically directed to do so by a representative of the carrier or of Data General Corporation.

Unpacking

Refer to the illustration below when unpacking the drive unit. Save all packing materials, and proceed as follows:

Open the shipping container by slitting the sealing tape and opening the end flaps.

Slide the drive unit, together with its styrofoam shipping inserts, out of the container.

Remove the two styrofoam shipping inserts from the drive unit.

Slide the polyethylene bag off the drive unit.

Remove the mounting hardware kit from the rear of the drive unit.

Slit the selaing tape on the carton containing the cables, and remove the cables. Handle the cables with care.

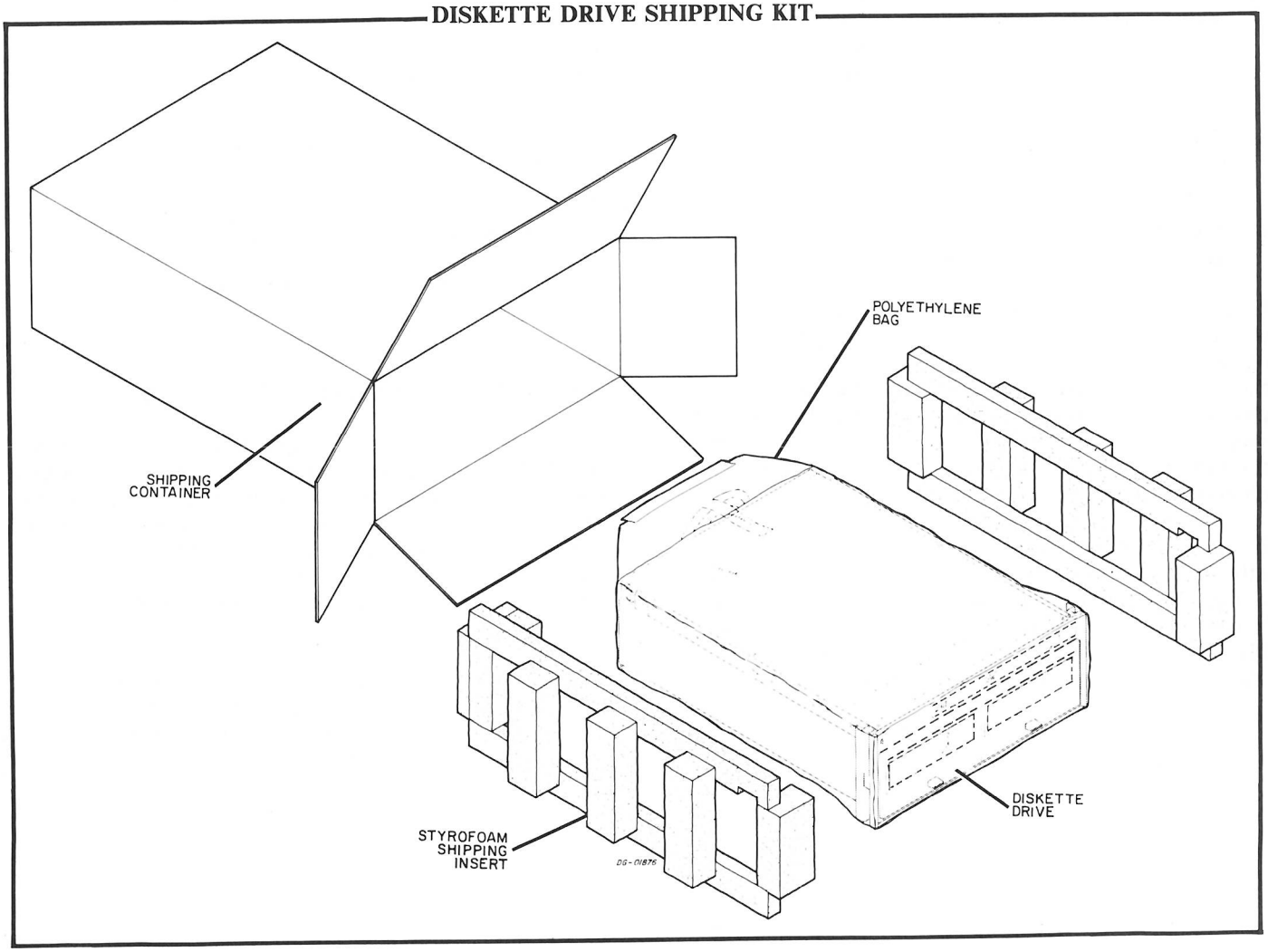
Power Requirements

It is good practice to confirm that the unit's power requirements match the available power supply. Remove the power supply cover plate, centrally located on the chassis back panel, and note the operating voltage and frequency printed on the cover plate. Check that these values are correct. If the unit's requirements do not match the available supply, contact the nearest Data General representative. The unit's power requirements are NOT easily altered in the field, and no attempt should be made to do so. Check that the fuses (or fuses and circuit breaker) have the correct rating, as listed in Appendix A. Replace the power supply cover plate.

Grounding Requirements

To protect operating personnel, the National Electrical Manufacturer's Association (NEMA) recommends that the unit be grounded. Each unit is equipped with a three conductor power cable which, when connected to an appropriate receptacle, grounds the unit. The center pin of the power plug provides the ground connection.

DISKETTE DRIVE SHIPPING KIT



PRELIMINARY CHECKOUT

Before mounting the enclosure in a cabinet, it is good practice to verify that the basic electro-mechanical functions are operating properly. The unit is rigorously tested at the factory, and any malfunction discovered during a preliminary check-out indicates damage incurred during shipment. The basic testing procedure is detailed in the table on the following page. This procedure tests the unit's drive mechanism and a portion of its control logic and does not require the drive to be connected to a computer.

Before performing the checkout procedures, the cable connections within the drive enclosure should be inspected. The connections are securely made before the unit is shipped, but some may have become loose or disconnected during shipment. All connectors are easily inspected from the top of the unit after the top cover has been removed. The figure shows the correct location and orientation of these connectors. If the enclosure contains only one drive, there will be an unconnected plug (drive motor cable plug) inside the enclosure. To inspect the connectors, remove the four screws which secure the top cover, lift the front of the cover to clear the front panel, and slide the cover forward, up and off. Be careful not to strike any of the components inside the enclosure. Ensure that all connections are correct and secure. No cables will be attached to the two device cable connectors (P1 and P2), located on the right of the adapter board viewed from the rear. If the unit is obtained as the only or last unit in the subsystem, a terminator board is installed on the lower edge connector (P2). Ensure that the terminator is oriented downward and is secure. If the unit is obtained as an add-on unit, no terminator is installed. Replace the top cover; it must be removed after the enclosure is mounted in a cabinet, to install the device cable, but it should be replaced at this point to prevent inadvertent damage to the internal components during mounting.

Preliminary Checkout

The following procedures exercise the disc unit's electro-mechanical assemblies and the related control logic. The checkout should be performed when the unit is placed on a bench and not cabled to a computer. It is assumed that the unit's power requirements have been met by the available ac supply. If the expected result is not confirmed for any procedure, begin the set of procedures over again. If a faulty condition persists, contact the nearest Data General Field Service representative for assistance.

Procedure	Expected Result
(1) Turn the power switch on the front panel to OFF. Plug the power cord into the ac receptacle, and turn the power switch to ON.	(1) The POWER ON and WRITE LOCK indicator lights will glow. The TRACK 0 light may glow. The cooling fan at the rear of the chassis will run.
(2) Open the drive door and visually inspect the spindle. (A flashlight may be helpful.)	(2) The spindle will be spinning.
(3) Remove a diskette from its storage envelope, check that the "Write Enable" tape is NOT attached, and slide the diskette all the way into its position in the drive as shown. NOTE: The label on the disc must be facing upwards.	(3) The diskette will come up against a solid stop.
(4) Close the drive door and ensure that it latches shut.	(4) The three indicator lights above the drive will glow. These are labeled READY, TRACK 0, and WRITE LOCK.
(5) Open the drive door.	(5) The three indicator lights above the drive will turn off; the POWER ON indicator will continue to glow.
(6) Remove the diskette, attach a piece of tape (supplied with the disc) over the "Write Enable" hole in the disc, and insert the disc into the drive.	(6) The diskette will slide freely in and out of the drive.
(7) Close the drive door and ensure that it latches shut.	(7) The indicator lights labeled READY and TRACK 0 will glow. The WRITE LOCK indicator will remain off.
(8) Open the drive door and remove the diskette.	(8) The READY light above the drive will turn off; the POWER ON, WRITE LOCK, and TRACK 0 lights will continue to glow.

DG-01921

This completes the preliminary checkout for one diskette drive. If the unit contains two drives, repeat procedures 2 through 8 for the second drive. When proper operation is verified, turn the POWER ON switch to OFF and unplug the power cord. Close the drive door(s), and proceed to mount the unit in an equipment cabinet, as described in the following section.

Installing the Drive Unit in a Cabinet

The diskette drive unit is usually installed on slide-rails in a standard 19" wide equipment cabinet. When the unit is shipped, the rails are assembled onto the chassis. Remove the slides, fasten them to the cabinet rails, and slide the diskette unit into position in the cabinet. Connecting the cables completes the installation.

Some considerations should be given to the location of the drive unit in the cabinet.

The unit is 7" high, and no additional spacing between the unit and adjacent rack-mounted equipment is necessary. Each unit is equipped with a cooling fan inside the chassis, and no extra cooling is required. If other equipment is located in the same rack as the diskette unit, however, ensure that the chassis does not block the cooling air flow to the other equipment. In particular, the diskette unit must not be placed directly over the blower at the bottom of the cabinet. Allow sufficient space for routing an air hose from the blower to equipment in the rack which requires external cooling.

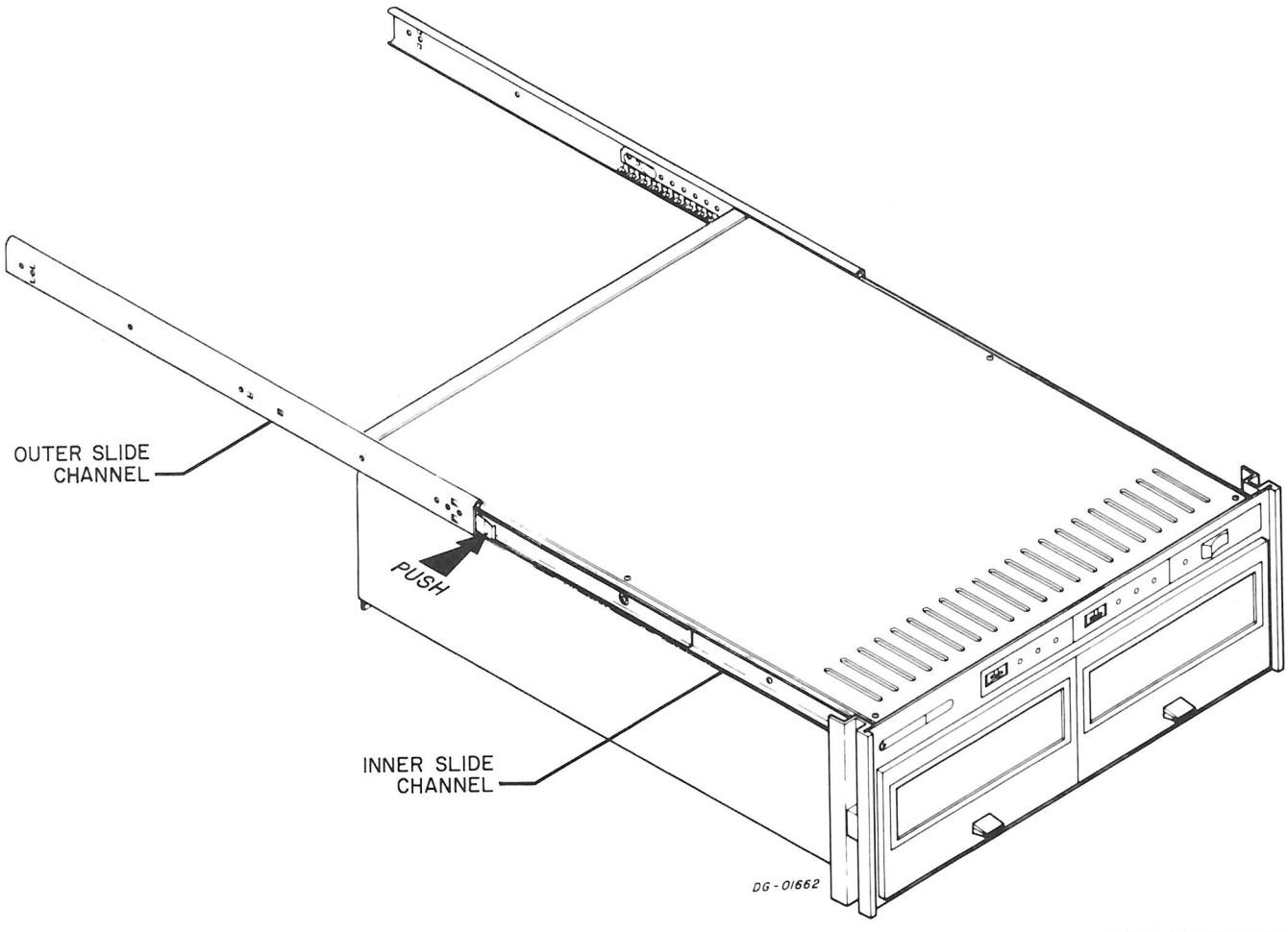
For operator convenience, the drive unit should be positioned at a height which provides good access to the front panel. The diskettes are easily removed and replaced, and a convenient location is desirable.

The final consideration when positioning the unit in a standard equipment cabinet involves the staggered hole spacing in the cabinet rails. The top of the unit front panel should be between two holes with 1/2" center-to-center spacing, so that the slide brackets' holes will align with those in the rails.

The drive unit may be ordered with either one or two drives in the chassis. The procedures for mounting the unit in a cabinet is the same in either case, and the hardware required is supplied with the unit. After selecting a location in an equipment cabinet, install the diskette unit in the cabinet as follows:

1. Remove the outer slide channels from both sides of the enclosure by pulling each slide channel back until the detent engages, pressing the detent to release it, and pulling the slide channel off the enclosure. Leave the inner slide channels fastened to the enclosure.

REMOVING OUTER SLIDE CHANNELS

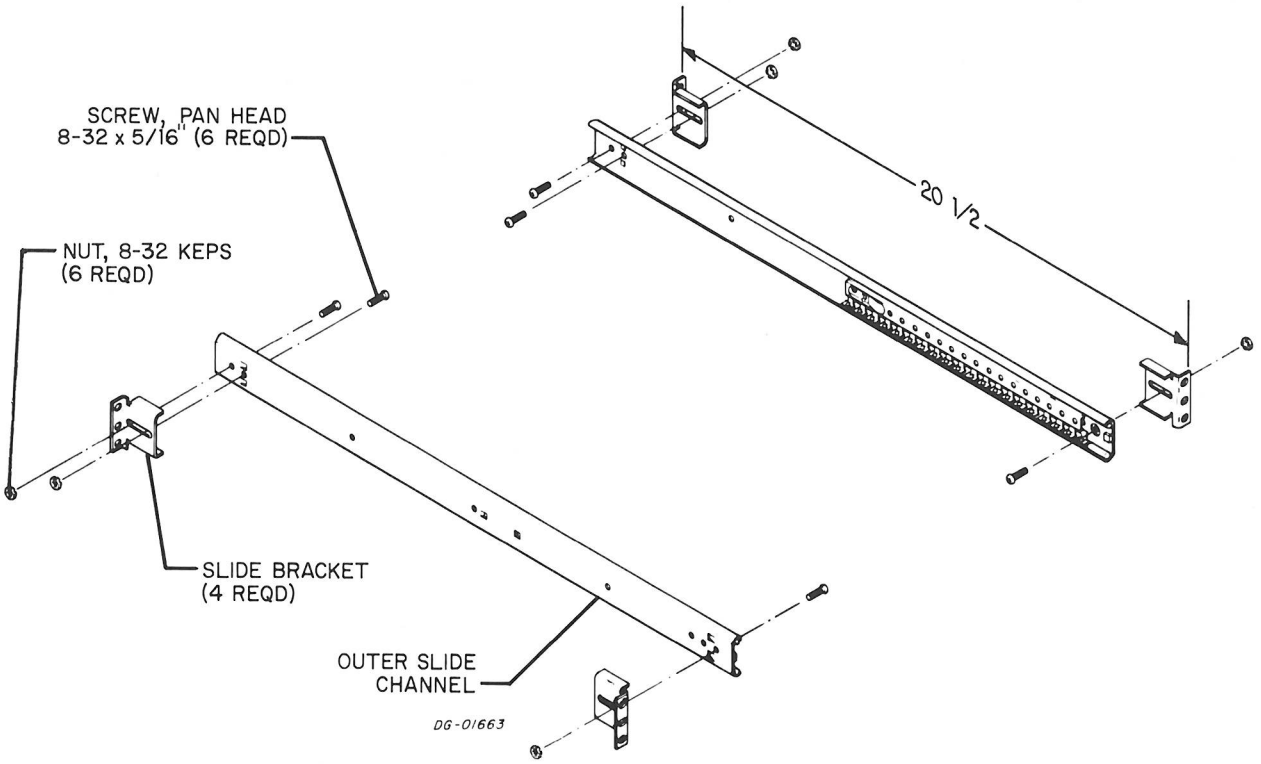


2. Attach a slide bracket to the rear of each outer slide channel. (The front of the slide channel is identified by the nylon inserts.) Note that the brackets are not symmetrical, and must be positioned as shown with the elongated side extended downward from both slide channels. Secure each bracket with two 8-32 x 5/16" panhead screws and two 8-32 Keps nuts, with the nuts on the outside of the slide channel. Slide each bracket forward as far as the rear screw will allow, and tighten it in this position.

3. Attach a slide bracket to the front of each slide channel. Note that the brackets are not symmetrical, and must be positioned as shown with the elongated side extended downward on both slide channels. Secure each bracket with an 8-32 x 5/16" panhead screw and an 8-32 Keps nut with the nut on the outside of the slide. Before tightening the screw, adjust the bracket's position to 20 1/2" from the rear slide bracket, as measured from the outside faces of the brackets. Tighten the screw securely.

NOTE The slide bracket will be set back from the front edge of the slide by approximately 1/8".

ATTACHING SLIDE BRACKETS



4. Fasten the outer slide channels to the cabinet rails at the location chosen for the diskette drive unit. The upper screw hole of the slide bracket should align with the lower of a pair of rack holes spaced on 1/2" centers. The top of the front panel will then lie between the two 1/2" spaced holes.

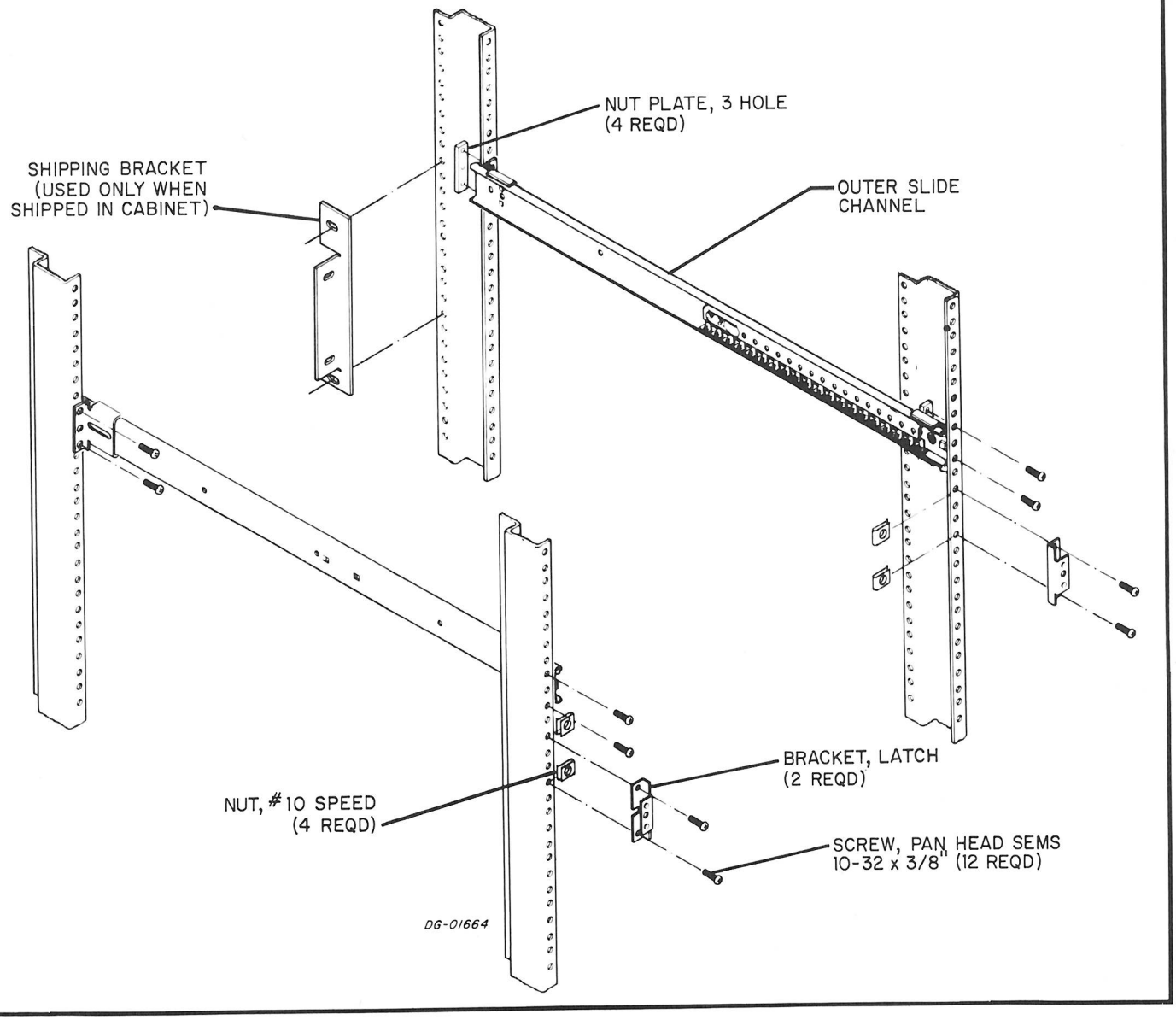
   NOTE The order of assembly of the slide bracket and nut plate onto the cabinet rails is different at each end of a slide channel. Carefully follow the illustration for proper assembly. Note that each slide bracket fits on the inside edge of the cabinet rails.

   Secure each bracket to a cabinet rail with a 3 hole nut plate and two 10-32 x 3/8" Sems screws. Use the upper and lower holes in each three hole bracket, and tighten all screws securely.

5. Slide two #10 speed nuts onto the front of each cabinet rail. Position one at the second hole, and one at the fifth hole, below the bottom screw of the slide bracket.

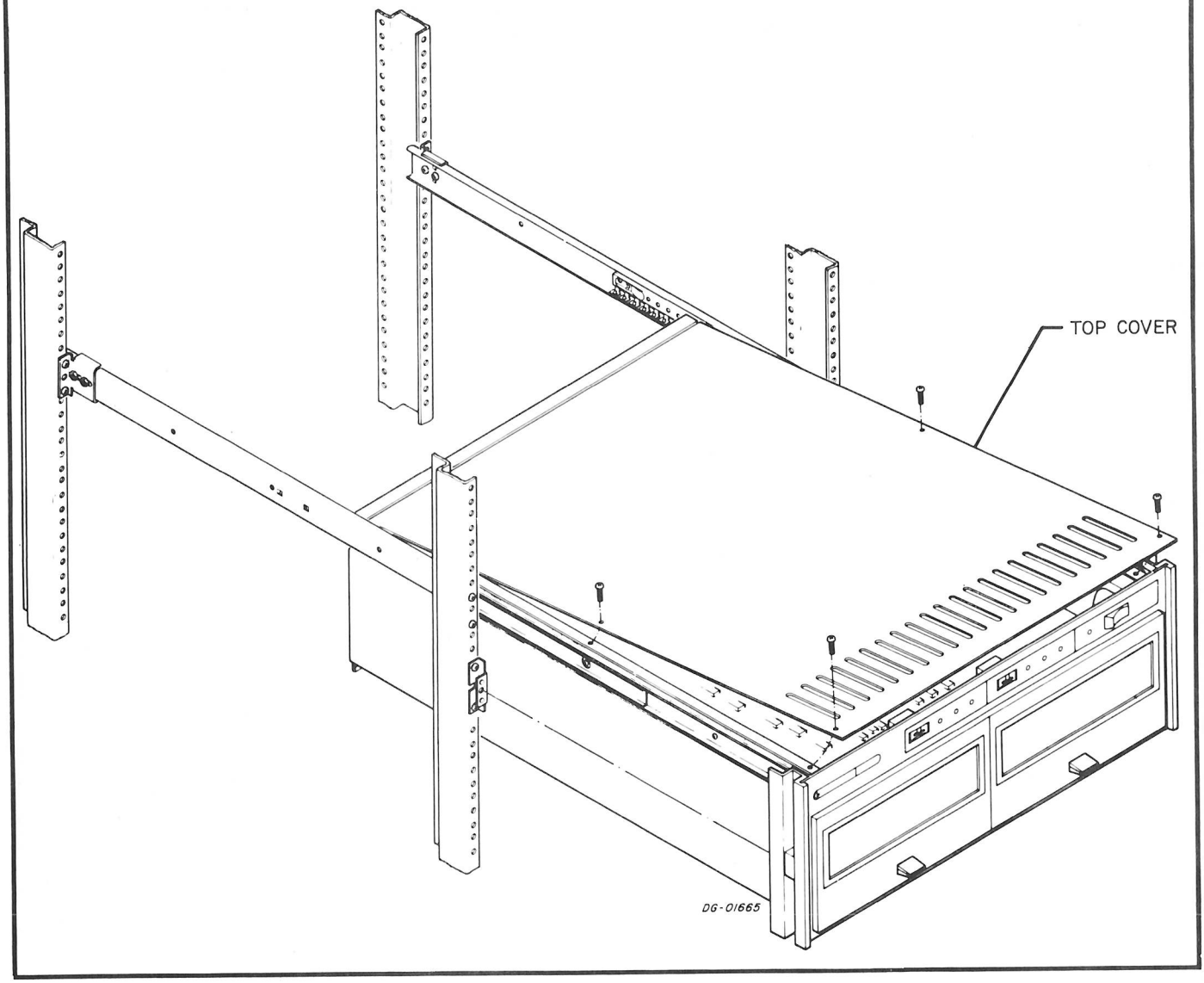
6. Attach a latch bracket to each cabinet rail, using the two #10 speed nuts and two 10-32 x 3/8" panhead Sems screws for each bracket. The open side of the bracket should face outward. Tighten the screws securely.

ATTACHING SLIDE CHANNELS TO CABINET RAILS



7. Remove the device cable cover plate from the rear of the enclosure.
8. Slide the enclosure into the cabinet by aligning the slides and pushing the enclosure into the cabinet until the detents stop it.
9. Remove the top cover by removing the screws, raising the front edge of the cover and sliding it forward and upward.

REMOVING TOP COVER



10. Insert the device cable(s) into the enclosure through the opening in the rear. Plug the edge connector into the 100 pin etch (P1 or P2) on the large PCB. The connector must be oriented as shown in the sketch.

11. Secure each device cable to the inside of the enclosure using a nylon cable clamp, flat washer and Keps nut.

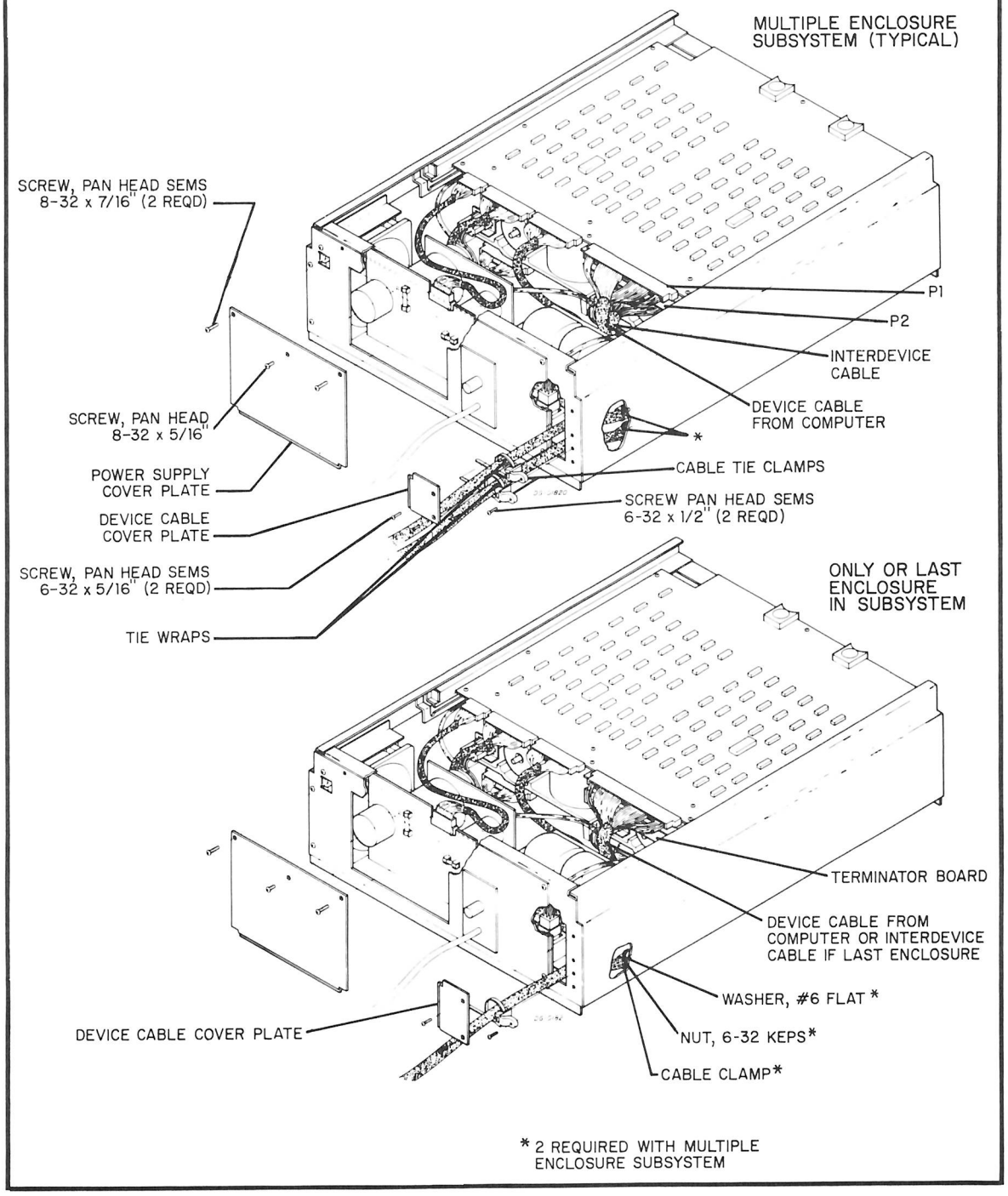
12. Release the rack detents on both sides of the unit and slide it back into its cabinet.

13. Work from the rear of the cabinet, and install a cable tie clamp on the rear of the enclosure in the position shown. One clamp is required for each device cable exiting from the chassis. Use one 6-32 x 1/2" panhead Sems screw for each clamp.

14. Tie each device cable to its clamp, so that the cable does not strain its connection inside the chassis.

15. Replace the offset device cable cover plate, and secure it with two Sems screws.

INSTALLING DEVICE CABLES


MULTIPLE ENCLOSURE SUBSYSTEM (TYPICAL)
SCREW, PAN HEAD SEMS 8-32 x 7/16" (2 REQD)
P1
P2
INTERDEVICE CABLE
DEVICE CABLE FROM COMPUTER
*
SCREW, PAN HEAD 8-32 x 5/16"
POWER SUPPLY COVER PLATE
CABLE TIE CLAMPS
SCREW PAN HEAD SEMS 6-32 x 1/2" (2 REQD)
DEVICE CABLE COVER PLATE
SCREW, PAN HEAD SEMS 6-32 x 5/16" (2 REQD)
TIE WRAPS
ONLY OR LAST ENCLOSURE IN SUBSYSTEM
TERMINATOR BOARD
DEVICE CABLE FROM COMPUTER OR INTERDEVICE CABLE IF LAST ENCLOSURE
WASHER, #6 FLAT *
DEVICE CABLE COVER PLATE
NUT, 6-32 KEPS*
CABLE CLAMP*
* 2 REQUIRED WITH MULTIPLE ENCLOSURE SUBSYSTEM

16. Slide the enclosure forward until the detents stop it, and check that the device cables are free to flex during this operation.

17. Work from the front of the cabinet, and recheck that the device cables (or cable and terminator board) are secure.

18. Replace the top cover. Ensure that the offset rear edge of the cover engages with the flange on the rear of the chassis. Secure the cover with four Sems screws.

19. Release both rack detents and slide the enclosure back into its cabinet. Open the latches on both sides of the front panel, slide the enclosure all the way in so that the fasteners engage, and latch the unit in position. The latches should be flush with the sides of the front panel when the fasteners are secured.

20. Verify that the ac line supply matches the unit's requirements, and plug in the power cord.

INSTALLING THE DISKETTE CONTROLLER

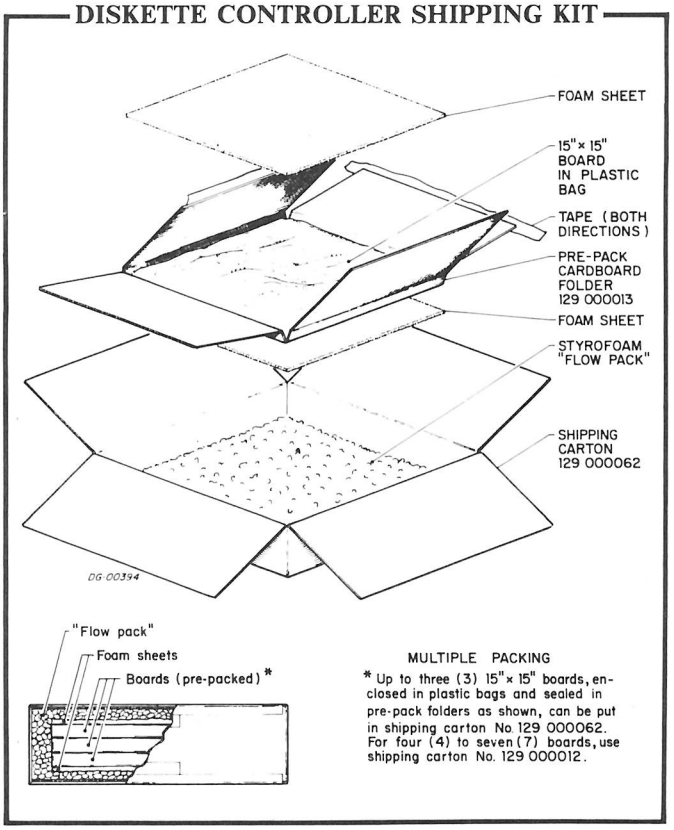
Installing the diskette subsystem controller in a NOVA line or an ECLIPSE line computer consists of unpacking the controller, choosing a device slot, developing priority structures, installing the internal cable, selecting the device code, and installing the controller in the computer in its selected slot.

Unpacking

NOTE Do NOT unpack cartons damaged in any way unless specifically directed to do so by a representative of the carrier or of Data General Corporation.

The diskette controller is shipped in the packing kit shown below. Unpacking is a straightforward procedure, but take care not to damage the printed circuit board, particularly when slitting the sealing tape. Handle the board carefully and do not flex it or damage it in any way.

DISKETTE CONTROLLER SHIPPING KIT


FOAM SHEET
15"× 15" BOARD IN PLASTIC BAG
TAPE (BOTH DIRECTIONS)
PRE-PACK CARDBOARD FOLDER 129 000013
FOAM SHEET
STYROFOAM "FLOW PACK"
SHIPPING CARTON 129 000062
DG-00394
"Flow pack"
Foam sheets
Boards (pre-packed) *
MULTIPLE PACKING
* Up to three (3) 15"× 15" boards, enclosed in plastic bags and sealed in pre-pack folders as shown, can be put in shipping carton No. 129 000062. For four (4) to seven (7) boards, use shipping carton No. 129 000012.

Choosing a Slot

The diskette subsystem controller may be placed in any device slot of a NOVA line or ECLIPSE line computer. Its position with respect to the other controllers mounted in the computer will normally determine its priority in the data channel and program interrupt priority systems. The structure of these priority systems is hard-wired on the computer back panel, and may be altered by cutting the etched conductors and/or installing jumper wires between slots, if modification of the structure is necessary. Without such modifications, the highest priority in both the data channel and the program interrupt systems is assigned to the controller mounted lowest in the chassis. Priority decreases with increasing slot position, so that lowest priority is assigned to the controller mounted highest in the chassis.

A detailed description of the data channel and program interrupt priority systems may be found in the Interface Designer's Reference Manual (DG #015-000031). As described in that reference, the slot choice is largely dependent on the peripheral's maximum allowable data channel latency time as compared to that of other controllers in the computer system. A diskette subsystem may contain only diskette drives or both diskette drives and 4234 disc drives, so the subsystem may have two different maximum latency times. When only diskette drives are configured, the maximum latency time is 128μs; when the subsystem consists of a mix of diskette drives and 4234 drives, the maximum latency time is 12.8μs. These values are used to choose the slot location for the diskette controller relative to the slot location of any other device controller in the computer system.

Developing Data Channel and Program Interrupt Priority Chains

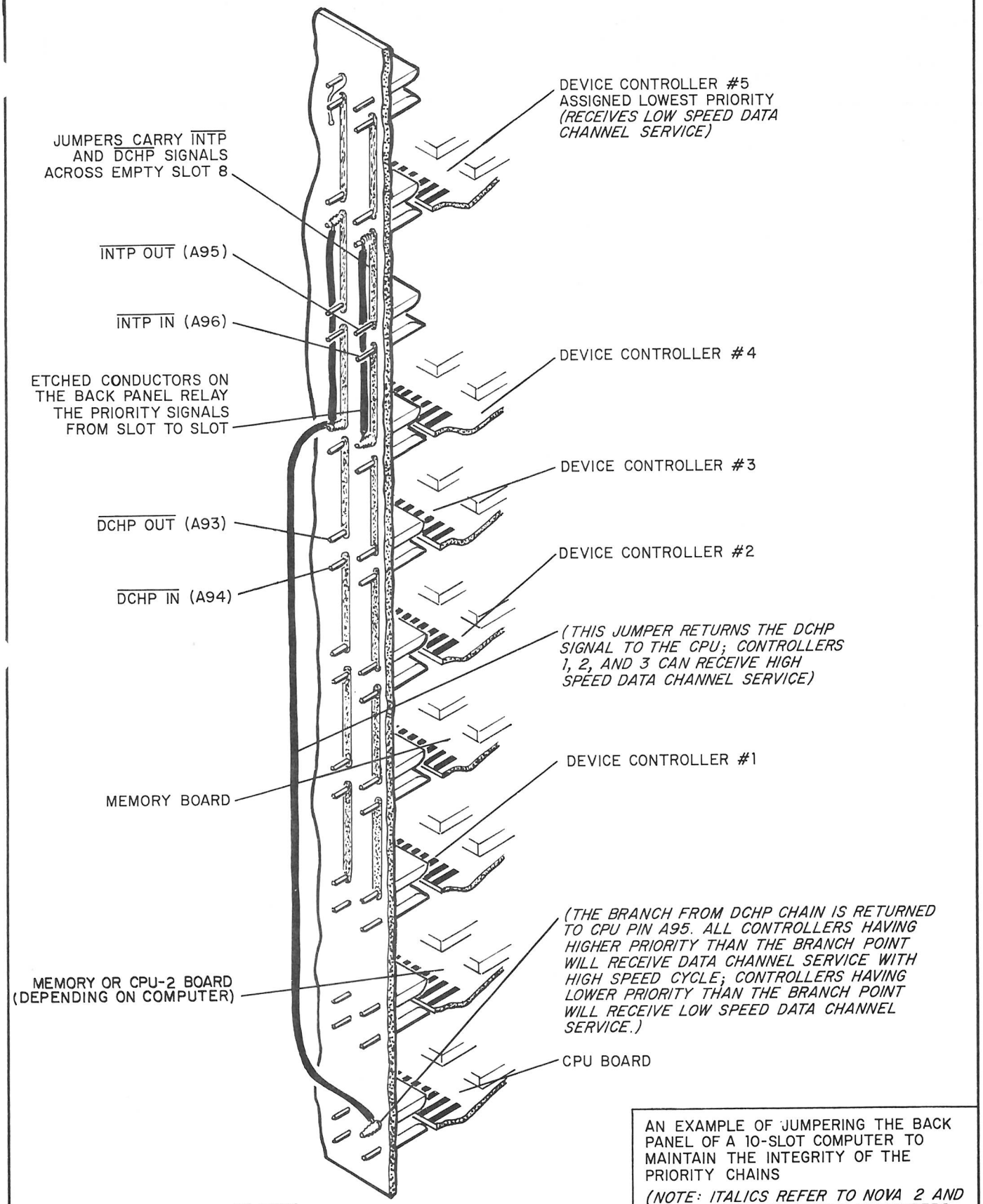
Two independent wiring chains on the computer's back panel develop the data channel and program interrupt priority systems. These systems each use a scheme in which an enabling signal, $\overline{\text{DCHP}}$ or $\overline{\text{INTP}}$, is wired in series through every controller in the system. Consult the Interface Designer's Reference Manual (DG #015-000031) for a detailed discussion of these systems.

It is necessary to ensure that the priority chains are maintained to include all controllers which require the priority services. The figure shows how the priority systems are implemented on the back panel. Etched conductors on the back panel carry the priority signals between device slots, and, when a controller board is installed in any slot, the signals continue to the next higher one. An empty slot terminates the chains, and prevents any controller located further up on the back panel from receiving either service. To include these controllers in the priority systems, the priority chains must be continued across any empty slots between controllers by installing jumpers on the back panel pins as shown. Empty slots do not require jumpers when they are located above the topmost controller in the chassis, unless an expansion chassis is used in the system. Consult the processor's technical manual for assistance when using an expansion chassis.

High Speed Data Channel Considerations

Certain types of Data General computers have the capability to perform data channel transfers at two rates, standard or high speed. Unless modifications are made to the back panel, all device controllers installed in the main chassis of these computers will transfer data at high speed. If desired, some or all of the device controllers may operate at standard data channel speed by installing a jumper on the back panel. The figure shows an example of this modification implemented on a NOVA 2/10 computer. Consult the processor's technical manual for detailed information concerning this modification.

CHAINING DATA CHANNEL AND PROGRAM INTERRUPT PRIORITY SYSTEMS


DEVICE CONTROLLER #5
ASSIGNED LOWEST PRIORITY
(RECEIVES LOW SPEED DATA CHANNEL SERVICE)
JUMPERS CARRY INTP AND DCHP SIGNALS ACROSS EMPTY SLOT 8
INTP OUT (A95)
INTP IN (A96)
DEVICE CONTROLLER #4
ETCHED CONDUCTORS ON THE BACK PANEL RELAY THE PRIORITY SIGNALS FROM SLOT TO SLOT
DEVICE CONTROLLER #3
DCHP OUT (A93)
DEVICE CONTROLLER #2
DCHP IN (A94)
(THIS JUMPER RETURNS THE DCHP SIGNAL TO THE CPU; CONTROLLERS 1, 2, AND 3 CAN RECEIVE HIGH SPEED DATA CHANNEL SERVICE)
DEVICE CONTROLLER #1
MEMORY BOARD
(THE BRANCH FROM DCHP CHAIN IS RETURNED TO CPU PIN A95. ALL CONTROLLERS HAVING HIGHER PRIORITY THAN THE BRANCH POINT WILL RECEIVE DATA CHANNEL SERVICE WITH HIGH SPEED CYCLE; CONTROLLERS HAVING LOWER PRIORITY THAN THE BRANCH POINT WILL RECEIVE LOW SPEED DATA CHANNEL SERVICE.)
MEMORY OR CPU-2 BOARD (DEPENDING ON COMPUTER)
CPU BOARD
DG-01934
DG-00768

AN EXAMPLE OF JUMPERING THE BACK PANEL OF A 10-SLOT COMPUTER TO MAINTAIN THE INTEGRITY OF THE PRIORITY CHAINS

(NOTE: ITALICS REFER TO NOVA 2 AND NOVA 800 SERIES COMPUTERS ONLY)

Device Code Selection

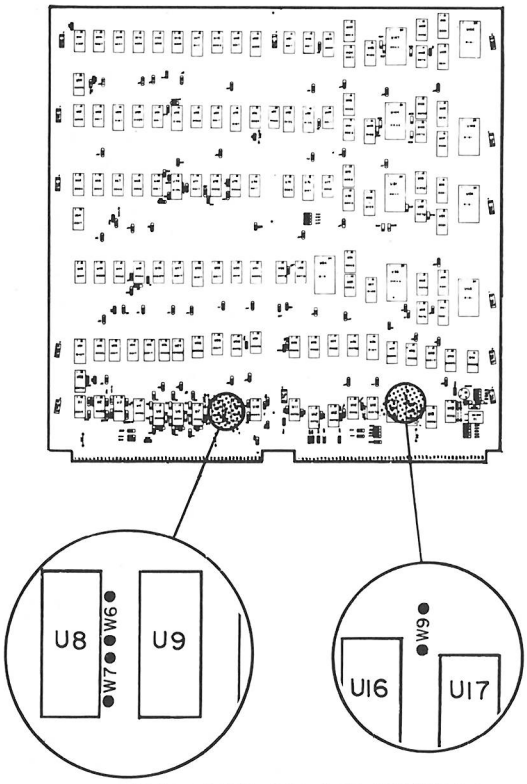
The six least significant bits of any I/O instruction uniquely identify the peripheral device being addressed, and are called the peripheral's device code. The diskette subsystem controller will respond to one of two device codes, 33_8 or 73_8. Device code 33_8 is normally assigned to the first diskette controller in a computer system, while code 73_8 is assigned to the second such controller.

The device code is selected by inserting certain jumper wires on the diskette controller board. There are 13 jumper positions, labeled W1-W3, on the board. Three of these, W6, W7, and W9, are used to select the controller's device code. The illustration locates these three jumper positions, and the table indicates which ones have jumper wires inserted for each of the two device codes.

Jumper Position	Device Code 33	Device Code 73
W6	Jumper inserted	Jumper removed
W7	Jumper removed	Jumper inserted
W9	Jumper removed	Jumper inserted

Insert or remove jumper wires as required to select the desired device code. Do not disturb any of the 10 remaining jumper positions; they are used primarily for testing purposes.

DEVICE CODE JUMPER POSITIONS



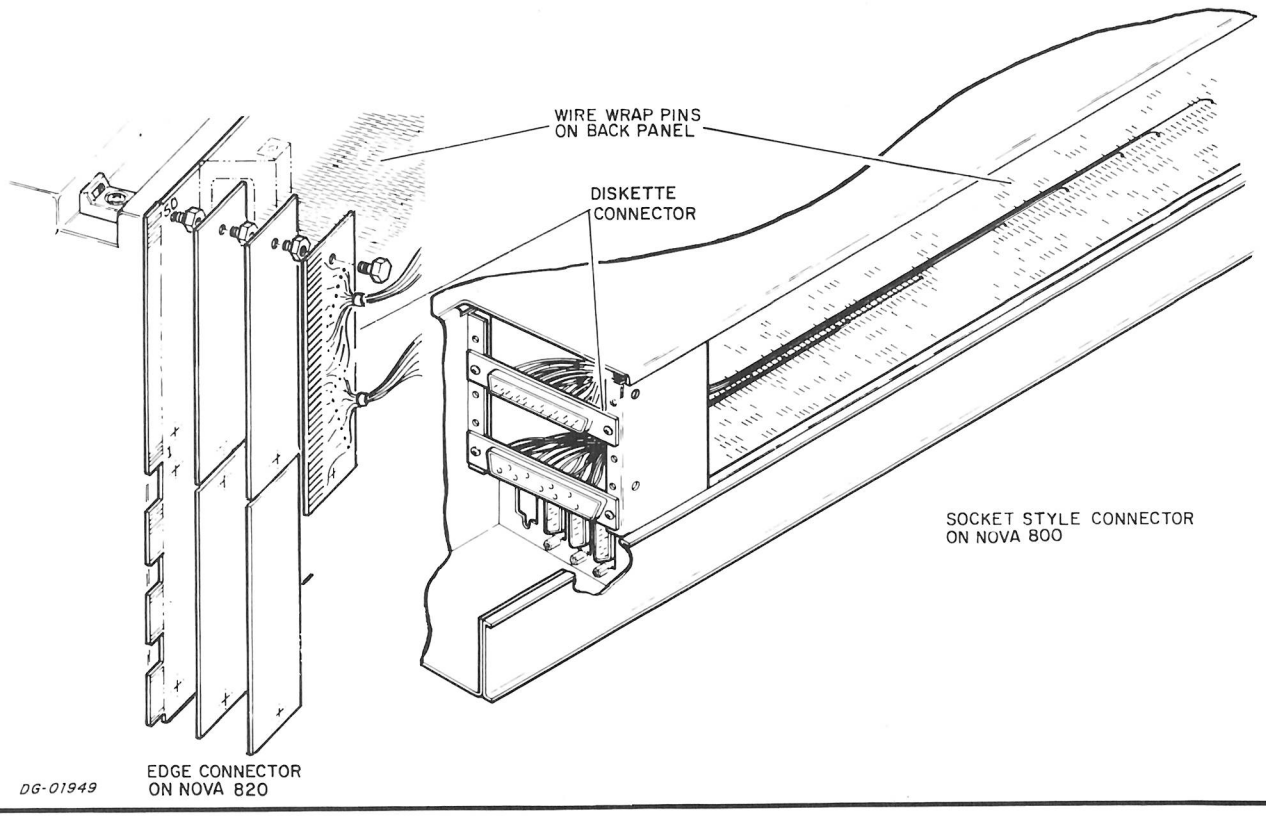
DG-01927 REF BOARD DGC 007-000187-04

Internal Cable

Signals between the processor and the diskette controller travel through etched conductors on the back-panel, while signals between the controller and the diskette drives appear on the back panel pins at the controller slot position. An internal cable must be installed on the computer to carry these signals between the controller and the drive's device cable. Each series of DGC computers requires a unique internal cable, but in all cases it consists of a device cable connector with a number of individual wires to be wire-wrapped to the back panel pins. The cable numbers and pin assignments are tabulated below for the various series of DGC computers; the illustration shows typical installations of the two types of device cable connectors. Specific details for a particular processor may be found in the processor's technical manual.

Caution Pins on the back panel are extremely fragile, and damaging any of them may lead to extensive repairs. The internal cable should be connected to the pins by wire-wrapping only, and NEVER by soldering. Data General recommends that its field service personnel install the internal cable.

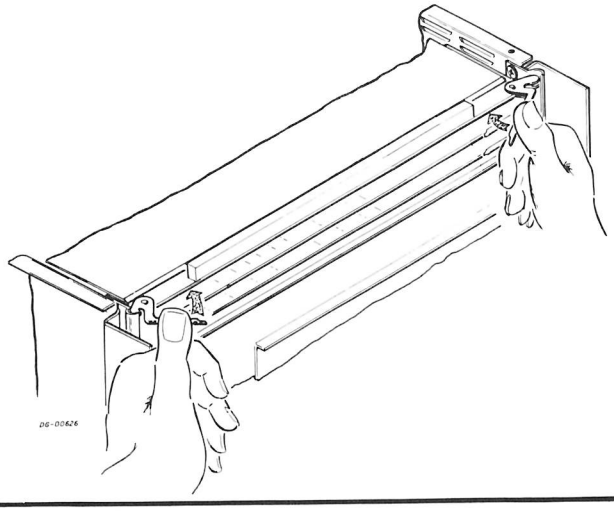
INSTALLING INTERNAL CABLE



Installing the Controller in the Computer Chassis

The controller is installed in the selected computer slot by carefully sliding it into the guides on each side of the chassis, with the component side facing up. It should slide smoothly and not bind. Locking tabs are provided to fully seat the edge connectors in the back panel sockets, as shown.

INSTALLING CONTROLLER INTO COMPUTER



Internal Cable Connections

Signal Names	Paddleboard Edge Connector Pin Numbers	Destination Pins On Computer Back Panel			Socket Connector Pin Numbers
		NOVA 2	NOVA 820, 1210 & 1220 & NOVA 800 1200	NOVA & SUPERNOVA Computers	
GND	A-A8		A99		
GND	1		A100		1
TA8	3		A91		16
ATTEN2	4		A78		30
RESTORE	5		A77		11
ATTEN3	6		A76		12
LFT SEL	7		A75		6
TA32	8		A73		4
TA128	9		A71		2
TA16	13		A63		27
RD CLK	14		A61		13
RD DATA	15		A59		14
DISKETTE	16		A57		5
SECT PULSE	18		A49		33
SK ERROR	19		A79		31
D0	20		A81		37
TA2	21		A84		17
HD1	22		A83		39
TAS	23		A86		40
RD/WR DISKETTE	24		A85		46
TA4	26		A87		47
TA1	27		A89		18
D1	31		B13		41
RD GATE	32		B15		38
TA256	33		B19		42
WR GATE	34		B23		43
FINISH	35		B25		20
WD CLK	36		B27		45
TA64	37		B31		44
DUR	38		B34		15
SA1	40		B38		34
CPU REQ	41		B40		19
ATTEN0	42		B48		35
ATTEN1	43		B49		36
SA2	44		B51		49
WR CHECK	46		B53		22
CPU SELECT	47		B54		29
SA8	48		B57		28
SA4	49		B58		3
HD2	30		B11		21
(not used)	2		A92		
"	10		A69		
"	11		A67		
"	12		A65		
"	17		A47		
"	25		A88		
"	28		A90		
"	29		B6		
"	30		B11		
"	39		B36		
"	45		B52		
"	47		B54		
"	50		A3		

Computer	Internal Cable Part Number
NOVA 2 Series ECLIPSE Line Computers	005-1802
NOVA 820, 1210 and 1220 Computers	005-901
NOVA 840, 1200 and 800 Jumbo Computers	005-469
NOVA 800 and 1200 Computers	005-469
NOVA, SUPERNOVA Computers	005-469
NOVA 830 Computer	005-469

DG-01922

CABLING THE DISKETTE SUBSYSTEM

This section describes the cabling scheme necessary to configure a diskette subsystem, whether it consists of 6030 series diskette units only or consists of a mix of 6030 series and 4234 series disc units. The physical connection at each drive, including the connector orientation and strain relief method, is not detailed here but can be found in the cabinet mounting procedures for the particular drive. When cabling a diskette subsystem, refer to these detailed procedures for proper interconnection.

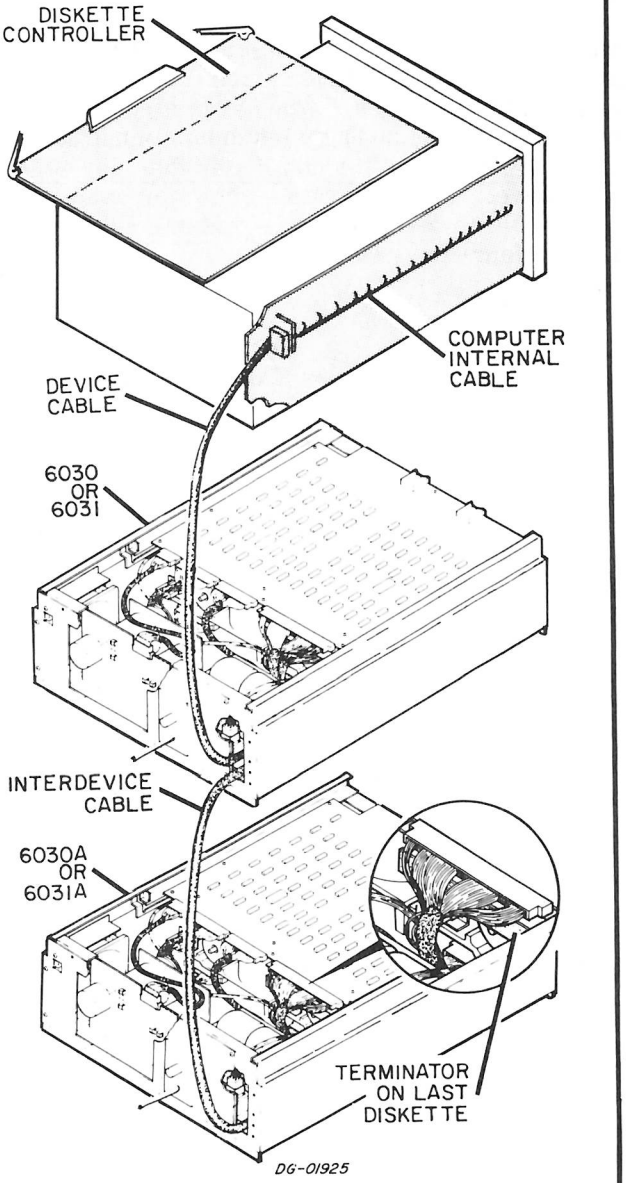
Cabling a 6030 Series Subsystem

A diskette subsystem may contain up to four 6030 series drive units. Cabling such a configuration involves connecting a device cable from the Data General computer to the first drive in the subsystem, connecting an interdevice cable between any subsequent drives in the subsystem, and properly terminating the last drive in the daisy chain. The illustration shows an example of cabling four drives (contained in two chassis) to a controller in a Data General computer.

Each diskette drive unit contains two identical edge connectors. The device cable from the computer is connected to the upper edge connector of the first drive in the daisy chain. An interdevice cable is connected from the lower edge connector of the first drive to the upper edge connector of the next drive in the daisy chain. A terminator board is installed on the lower edge connector of the last drive in the subsystem.

There are two types of device cables available, and the type of computer used in the system governs the choice of device cable. All interdevice (daisy chain) cables are identical. Consult the table of ordering information in the first section of this reference to order the correct equipment.

CABLING 6030 SERIES SUBSYSTEM

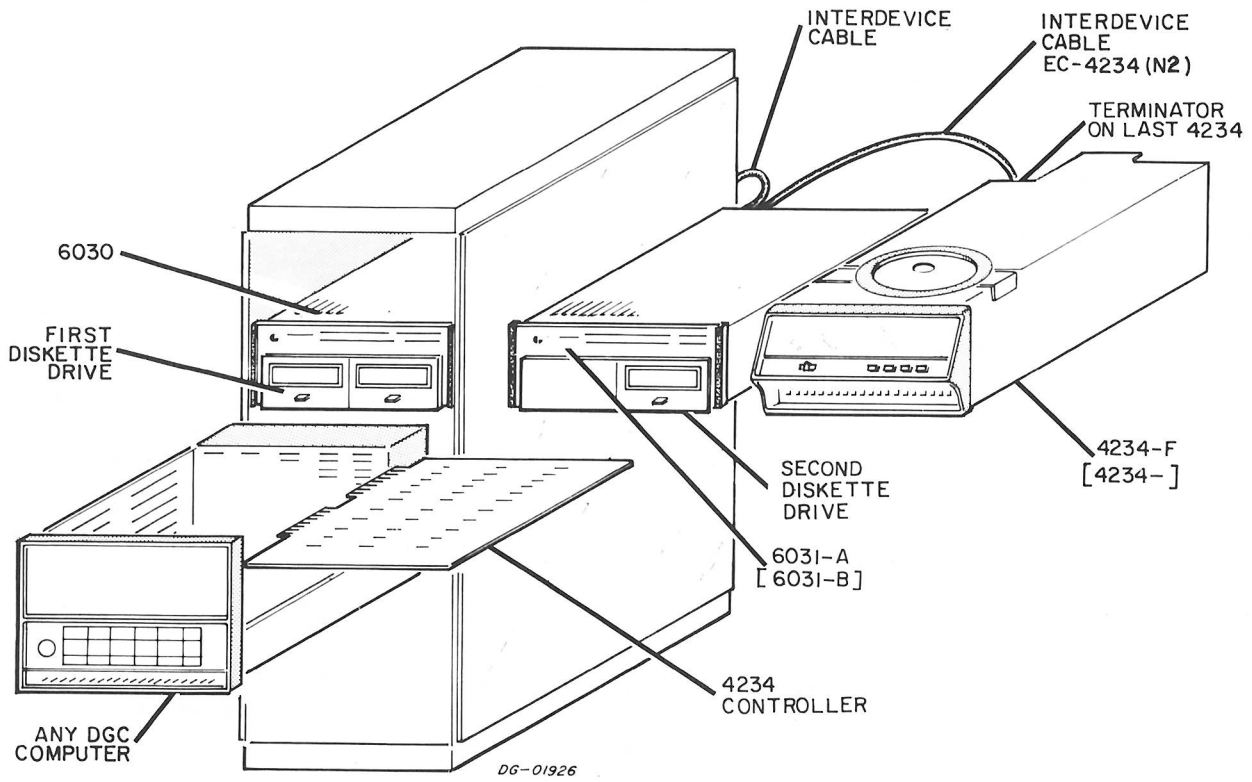


Cabling a 6030/4234 Series Mixed Subsystem

A mixed subsystem may contain a mix of 6030 series diskette units and 4234 series disc units, up to a total of four drives. When such a configuration is desired, all 6030 series drives must be electrically closer to the controller than any 4234 series drive. The illustration shows an example of cabling three diskette drives and one 4234 drive to form a four-drive subsystem.

The 6030 units in the hybrid subsystem use the same cables and cabling scheme indicated for the 6030 series subsystem above. The interdevice cable from the last 6030 unit to the 4234 unit, however, is a different type of table; this cable will be supplied with the subsystem when the entire subsystem is ordered at one time. When one or more 6030 drives are ordered to add onto an existing 4234 subsystem, however, this cable must be ordered explicitly. Consult the table of ordering information in Section I of this reference to order the correct equipment.

CABLING A 6030/4234 SERIES MIXED SUBSYSTEM



NOTE: THE MAXIMUM DEVICE CABLE LENGTH IS 30 FT.

SYSTEM TESTING

A complete reliability and diagnostic testing program is included with the documentation accompanying all 6030 series equipment. Program descriptions and operating procedures are also furnished, and subsystem operation should be tested with these programs once the installation is complete. It is good practice to run the reliability program periodically, to verify proper system performance.

SECTION V
MAINTENANCE

INTRODUCTION

The diskette drive unit should require no regular maintenance when it is operated in a reasonably clean environment. Contamination of the diskette and/or the transcription head would necessitate periodic cleaning, but contamination is largely eliminated by the self-cleaning action of the diskette packet. The inside of the packet is lined with a material which contacts the diskette and continuously wipes it clean when it rotates. However, if the unit operates in an adverse environment it may be necessary to set up a schedule of preventive maintenance. This procedure would consist of cleaning the drive's read/write head and enclosure. Cleanliness is crucial for proper performance; the primary cause of lost data is dirt on and around the diskette.

NOTE *Do NOT attempt to clean the diskette recording surface -- the protective packet, which may not be removed, will prevent successful cleaning. The diskette will not become contaminated if proper attention is paid to its operating environment and/or to regular maintenance as described below. If the diskette is contaminated through misuse, it should be discarded.*

ROUTINE MAINTENANCE PROCEDURE

Periodic maintenance consists of cleaning the read/write head and enclosure, and should proceed as follows:

1. Turn off the diskette power switch, release the latch fasteners, and slide the enclosure out on its rails.
2. Remove the top cover by removing four screws and lifting the cover up and off.
3. Label all of the edge connectors on the large printed circuit board and unplug them. Release the latches below the rear corners of the board, and remove the five screws which secure it to the chassis. Slide the board back and rotate it up on its hinges.

CAUTION *Handle the circuit board with care. Be careful not to flex it or damage it in any way.*

4. Gently clean the read/write head surface, using a clean cotton applicator dampened with a commercial head cleaning solution or with a 91% isopropyl alcohol. Repeat this procedure until no residue is picked up on the applicator.
5. Gently wipe the head with a dry applicator. Be sure that no lint is left on the head.
6. Repeat steps 4 and 5 for the second drive unit, if the enclosure contains two drives.
7. Vacuum clean the inside of the enclosure and in and around the drive(s) using a nonconducting nozzle.
8. Secure the large printed circuit board, and plug the edge connectors into their correct positions.
9. Replace the top cover, and secure it with four screws.
10. Release the rail detents, slide the enclosure into its rack, and secure it with the latch fasteners.
11. Wipe the front panel with a clean cloth dampened with a commercial cleaning solution.

REMOVING A DRIVE UNIT FROM ITS ENCLOSURE FOR ADJUSTMENTS AND REPAIRS

A drive unit must be removed from its enclosure whenever any adjustments or repairs are performed. The drive must be reconnected to the unit's logic and power supply and the necessary procedure may then be performed, as described in the device maintenaance manual. To set up the drive for an adjustment or repair, proceed as follows:

1. Turn off the power to the drive enclosure, slide the enclosure out on its rails until the detents latch, and remove the top cover (four screws).
2. Disconnect the drive by unplugging the drive-to-adapter board cable and the spindle motor cable.
3. Place the top cover on top of the enclosure, rotated 90° from its normal position, to provide a service area for the drive.
4. Remove the four securing screws from the bottom of the enclosure, and carefully slide the drive out of the enclosure. Place the drive on the top cover, so that the cables may be reconnected.
5. Reconnect the two cables to the drive unit, so that it may be operated normally during the service procedure.

ALIGNMENT ---- READ/WRITE HEAD

A head alignment procedure is performed to ensure that read/write operations always start at the beginning of a sector within the boundaries of the proper track. It is typically done when a new head is installed or when the diskettes cannot be interchanged among different drive units. The alignment procedure involves:

a. adjusting the setting of the TRACK 0 switch
b. adjusting the position of the head
c. adjusting the position of the Index transducer.

Each of these adjustments involves attaching oscilliscope probe(s) to the drive circuitry and making the mechanical adjustments necessary to produce signals on the oscilliscope which indicate that the drive is operating correctly.

Special Tools Required

A blank DGC diskette
Alignment diskette, 118-000518
Cartridge/Diskette Reliability: Tape, 095-000299
Listing, 096-000299
Dual-trace oscilloscope
Small C-clamp (approx. 2 in. opening)
Small stick such as a Q-tip or pencil
Ball Allen screwdriver
Torque Seal (available from DGC representative)

ADJUSTMENT OF THE TRACK 0 SWITCH SETTING

The accuracy of the TRACK 0 switch setting ensures that the head is performing read/write operations within the boundaries of the proper track.

Procedure

1. Remove the drive from the enclosure and set it up for operation, as described in the Maintenance section of this manual.
2. Load the Reliability program into the computer.
3. Set up the oscilloscope to read the TRK 0 signal. The scope setup is as follows:

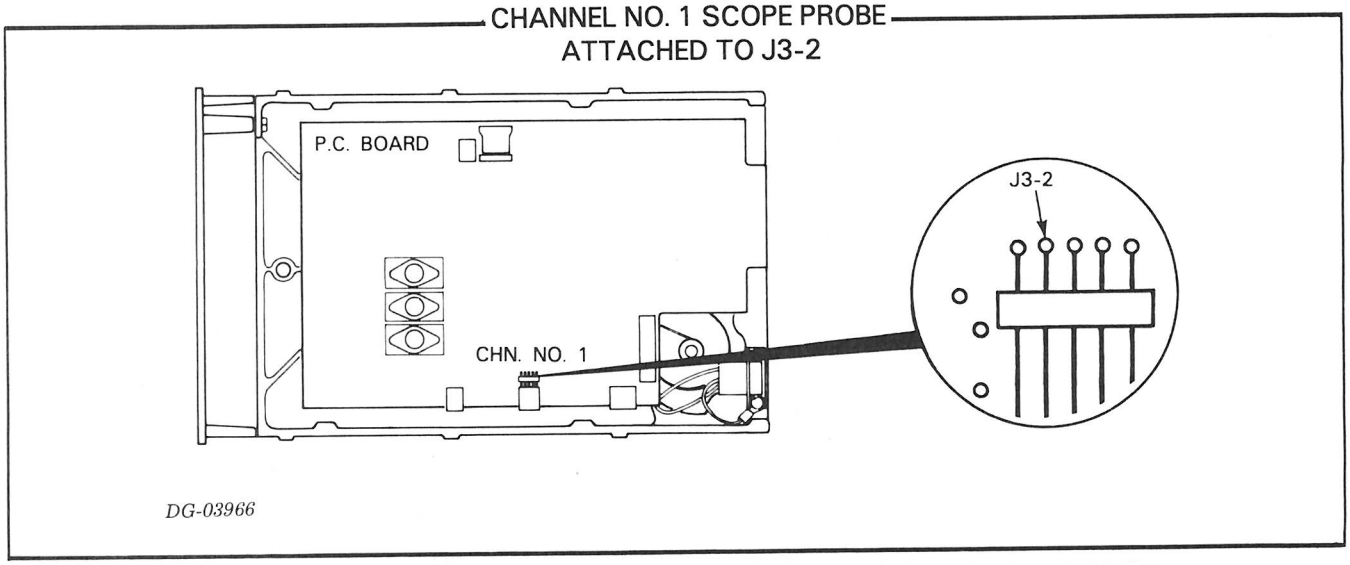
a. Chn. No. 1	J3-2
b. V/Div.	2 Vdc
c. Sync. So.	Normal
d. T/Div.	10 ms
e. Trig. mode	Normal
f. Vert. mode	Normal
g. A trigger level	Adjust
h. Horiz. display	A
i. Coupling	HF Rej.

4. Insert a DGC diskette into the drive and close the door.
5. Start the computer at location 505 (octal) using the console switches.
6. Verify that the TRK 0 switch is properly adjusted:

   Use the TTY device to initialize the drive and issue continuous seek commands between tracks 0 and 1. The command string is shown below.

TTY	USER RESPONSE
"UNIT"	chassis adapter select switch followed by a carriage return
"DATA"	carriage return
"COMMAND STRING"	type "SEE 0 SEE 1 LOOP" followed by a carriage return

Observe the TRK 0 signal; it should have a 50% ± 10% duty cycle. If not, loosen the switch bracket and adjust it until the signal is correct. Be sure to recheck the signal after tightening the mounting screw.



ADJUSTMENT OF THE HEAD POSITION

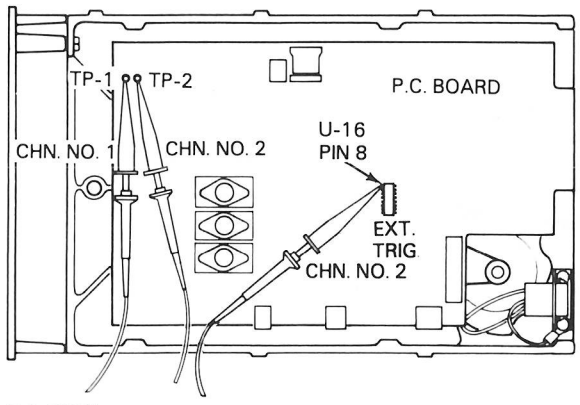
This procedure is necessary to ensure that the head is positioned within the acceptable limits of the track radial location at the start of read/write operations.

Procedure

1. Reset the computer using the RESET console switch.
2. Set up the scope as shown below to display the read signal.

a. Chn. No. 1	T.P.-1
b. V/Div.	0.1Vdc
c. Chn. No. 2	T.P.-2
d. V/Div.	0.1Vdc
e. Ext. Trig.	U16-8
f. Sync. Source	External
g. T/Div.	20ms
h. Trig. Mode	Normal
i. Vert. Mode	Add
j. Invert Sw.	On (In)
k. A trigger level	Adjust
l. Coupling	HF Rej.

SCOPE PROBES ATTACHED TO TEST POINTS 1 & 2



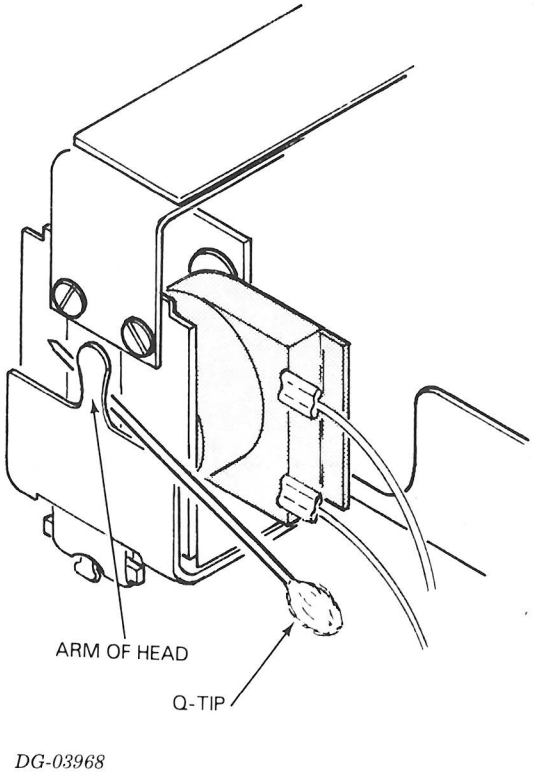
3. Remove the alignment diskette and insert a DGC diskette.
4. Start the computer at location 505 (octal) using the console switches.
5. Use the TTY device to initialize the drive and issue a seek command to track 46 (octal). The command string is as follows:

TTY	USER RESPONSE
"UNIT"	Number corresponding to F.D.D. chassis adapter select switch followed by a carriage return
"DATA"	carriage return
"COMMAND STRING"	type "SEE 46" followed by a carriage return

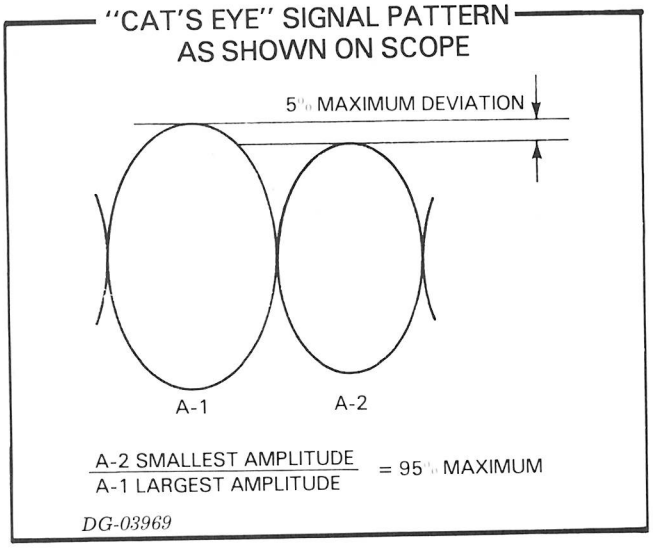
The head is now positioned at track 46 (octal).

6. Remove the DGC diskette and insert the alignment diskette.
7. Manually load the head by depressing the solenoid arm down to the stop. This can be accomplished by inserting a Q-Tip behind the arm. The head is spring-loaded and will unload unless held down manually.

MANUAL HEAD LOADING



8. Observe the "Cat's Eye" display by adjusting H.F.Stab. on scope. The figure below shows the acceptable limits. Note that, although a 20% deviation is acceptable, a 5% deviation is required if the head needs to be aligned, i.e. if deviation is more than 20%. When actually aligning the head, it is good practice to set it as exactly as possible; then, even if the head drifts somewhat, it will still remain within the outer limit of 20% deviation.


"CAT'S EYE" SIGNAL PATTERN AS SHOWN ON SCOPE
5% MAXIMUM DEVIATION
A-1
A-2
A-2 SMALLEST AMPLITUDE / A-1 LARGEST AMPLITUDE = 95% MAXIMUM
DG-03969

9. If necessary, align the head by rotating the stepper motor. Do this by loosening the hex head bolts on the motor support and rotating the motor CAREFULLY while observing the scope pattern. When the display is within 5%, retighten the bolts and check that the pattern does not drift outside of 5%. (After retightening the bolts, it is a good idea to apply Torque Seal to them to prevent further movement.)

CAUTION *The motor runs hot; be careful not to burn your hand. Attach a small C-clamp to the motor to turn it.*

10. Release the solenoid arm (the head will unload) and remove the alignment diskette.
11. Check that the adjustment does not drift. Return to step 6 and repeat the adjustment check. Note that, although you have adjusted the head to 5% deviation, the "Cat's Eye" pattern may now show more, due to drift. This is acceptable, providing there is never more than 20% maximum deviation.

    REPEAT STEP 11 (unloading the alignment diskette, seeking to track 46, loading the alignment diskette, and reading the scope deviation) THREE TIMES TO VERIFY THAT THE ALIGNMENT WILL NOT DRIFT BEYOND TOLERANCE LIMITS DURING USE.
12. Once the head position is properly adjusted, verify that the TRK 0 signal still displays 50% ±10% duty cycle during continuous seeks between tracks 1 and 0. Readjust the track 0 switch if necessary.

ADJUSTMENT OF THE INDEX TRANSDUCER POSITION

This procedure ensures the initialization of the sector count at the beginning of the first sector is within the sector boundary.

1. Reset the computer using the RESET switch on the console.
2. Load the drive with a DGC diskette.
3. Start the computer at location 505 (octal). The Cartridge/Diskette Reliability program should still be in the processor.
4. Use the TTY device to initialize the drive and position the head at track 114 (octal). The command string is shown below.

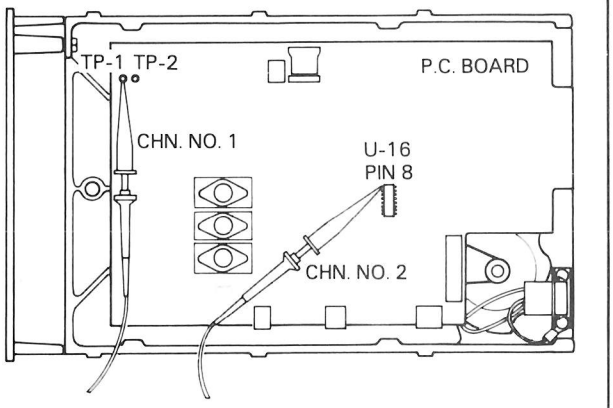
TTY	USER RESPONSE
"UNIT"	Number corresponding to F.D.D. chassis adapter select switch followed by a carriage return
"DATA"	carriage return
"COMMAND STRING"	type "SEE 114" followed by a carriage return

5. Remove the DGC diskette and load the drive with the alignment diskette.
6. Set up the oscilloscope to read the INDEX signal and the Write/Splice signal. The scope setup is as follows:

a. Chn. No. 1	T.P.-1
b. V/Div.	0.1Vdc
c. Chn. No. 2	U16-8
d. V/Div.	2Vdc
e. Ext. Trig.	N/A
f. Sync. Source	Chn. No. 1
g. T/Div.	50 microseconds
h. Trig. Mode	Normal
i. Vert. Mode	Add
j. Invert Sw.	Off (Out)
k. A trigger level	Adjust
l. Coupling	HF Rej.

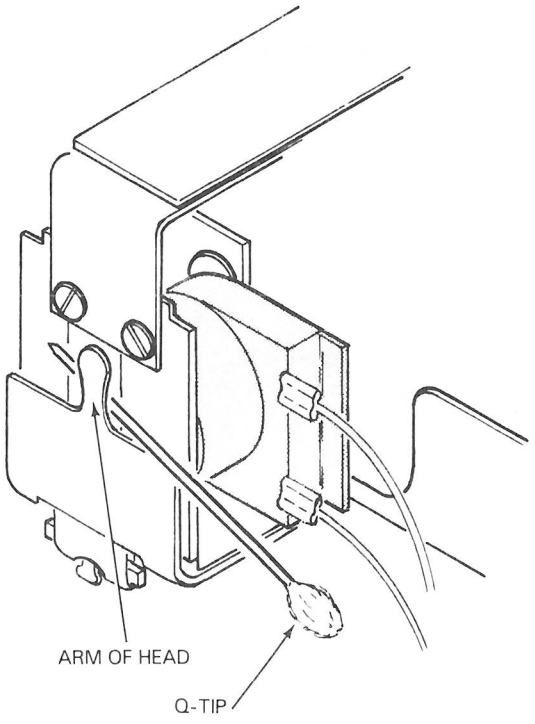
7. Load the head manually by depressing the solenoid arm down to the stop. The head is spring-loaded and will automatically unload unless held down. This can be easily accomplished by inserting a Q-Tip stick behind the head as shown in the diagram below.

SCOPE PROBES AS SET UP FOR TESTING THE INDEX TRANSDUCER



DG-03970

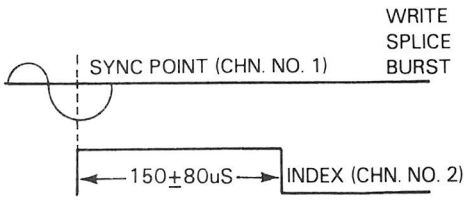
MANUAL HEAD LOADING



DG-03968

8. Observe the scope trace and adjust the index transducer as necessary. The signals should appear as shown below. If the time interval displayed is outside the tolerance, adjust the index transducer. Loosen the single hex head screw on the bottom of the drive casting and move the transducer until the signal is within tolerance. Tighten the screw and recheck the signal.

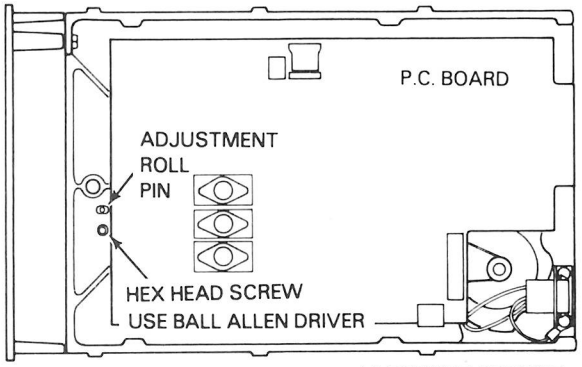
SIGNAL TIME INTERVAL AS SHOWN ON SCOPE



DG-03971

NOTE *The screw is located on the back side of the drive casting, as shown in the diagram below.*

ADJUSTMENT POINTS FOR INDEX TRANSDUCER



DG-03972

9. Unload the head by releasing the solenoid arm.
10. Reset the computer using the RESET switch on the console.
11. Remove the alignment diskette and load the drive with a DGC diskette.
12. Start the computer at location 505 (octal). The Cartridge/Diskette Reliability program should still be in the computer.
13. Use the TTY device to initialize the drive and position the head at track 1. The command string is as follows.

TTY	USER RESPONSE
"UNIT"	Number corresponding to F.D.D. chassis adapter select switch followed by a carriage return.
"DATA"	carriage return
"COMMAND STRING"	type "SEE 1" followed by a carriage return

14. Remove the DGC diskette and load the drive with the alignment diskette.
15. Load the head manually by depressing the solenoid arm down to its stop. The head is spring-loaded and will automatically unload unless held down manually. This can be accomplished by inserting a Q-Tip stick behind the head as shown in the diagram below.
16. Observe the scope display and ensure that the timing is the same as before (when the signal was measured at track 114). If the signal is not within the tolerance, adjust the Index transducer as in step 20. Alternate readings and adjustments at track 114 and track 1 until the burst-to-index timing is within tolerance at both tracks.
17. Check for timing drift. Remove the alignment diskette from the drive and reload it three times; check the signal timing each time you reload the diskette. Repeat this procedure when the head is positioned at track 1 and at track 114.
18. Disconnect the oscilloscope, turn power off, and reinstall the drive into its enclosure.

This page intentionally left blank.

APPENDIX A
TECHNICAL SPECIFICATIONS

GENERAL

Diskette speed:	360rpm ±3.5%
Recording mode	2F encoded
Data density:	3268bpi (inner track) 1836bpi (outer track)
Recording surfaces:	1
Tracks:	77_{10}
Sectors:	8_{10}
Words per data block (formatted):	256_{10} 16-bit words
Total storage capacity (formatted):	$157,696_{10}$ 16-bit words
Diskette media:	7.88in. diameter, 3 mil mylar
Active recording surface width:	1.5833in.
Head type:	Single gap, ceramic
Track width:	0.014in.
Track spacing:	0.02083in.
Track density:	48tpi
Track access time:	20ms track-to-track 770ms track 0-to-77
Head loading time:	60ms (overlaps with track access on combined commands)
Power required:	100/115/220/240Vac ±10%, 50/60Hz, single phase. 150W run, 220W Start, per drive
MTBF:	4000 operating hours (after initial 200 hours)
MTTR:	20 minutes

MECHANICAL

Overall dimensions:	19"W x 7"H x 24"D
Weight:	67lbs. (2 drives) 54lbs. (1 drive)
Mounting:	Standard 19" equipment cabinet
Power cable:	5° long

ENVIRONMENTAL

Temperature Range:	
Operating:	50° - 100°F
Storage:	-30° - 150°F
Temperature Range (Diskette media):	
Storage:	40° - 120°F
Relative Humidity Range:	
Operating:	20% - 80%
Storage:	5% - 95%
Altitude Range:	
Operating:	1000ft. below to 10,000ft. above sea level
Storage:	1000ft. below to 15,000ft. above sea level
Maximum stray magnetic field:	3979A/M

This page intentionally left blank

APPENDIX B
ORDERING INFORMATION

The table below summarizes model numbers and information pertinent to ordering the various components of a 6030 series diskette subsystem. When ordering diskette equipment, specify the type of Data General computer which will be used.

6030 SERIES DISKETTE SUBSYSTEM

FIRST DISKETTE DRIVE UNIT
(SUBSYSTEM CONTROLLER AND ONE OR TWO DRIVE UNITS)

(includes enclosure with drive(s), controller board, cables, mounting hardware and documentation)

Model	Number of Drives	Line Voltage	Line Frequency
6030	2	115Vac	60Hz
6030-1	2	100Vac	50Hz
6030-2	2	220Vac	50Hz
6030-4	2	240Vac	50Hz
6031	1	115Vac	60Hz
6031-1	1	100Vac	50Hz
6031-2	1	220Vac	50Hz
6031-4	1	240Vac	50Hz

ADDITIONAL DISKETTE DRIVE UNITS
(DRIVE UNIT(S) ONLY)

(includes enclosure with drive(s), cables, mounting hardware and documentation)

Model	Number of Drives	Line Voltage	Line Frequency
6030-A	2	115Vac	60Hz
6030-1A	2	100Vac	50Hz
6030-2A	2	220Vac	50Hz
6030-4A	2	240Vac	50Hz
6031-A	1	115Vac	60Hz
6031-1A	1	100Vac	50Hz
6031-2A	1	220Vac	50Hz
6031-4A	1	240Vac	50Hz

ADDITIONAL DISKETTE DRIVE UNITS
TO EXPAND EXISTING 4234 SERIES SUBSYSTEM

(includes enclosure with drive(s), cables*, mounting hardware and documentation)

Model	Number of Drives	Line Voltage	Line Frequency
6030-B	2	115Vac	60Hz
6030-1B	2	110Vac	50Hz
6030-2B	2	220Vac	50Hz
6030-4B	2	240Vac	50Hz
6031-B	1	115Vac	60Hz
6031-1B	1	100Vac	50Hz
6031-2B	1	220Vac	50Hz
6031-4B	1	240Vac	50Hz

*If the controlling computer is from the NOVA® 2 or ECLIPSE™ series, or is a NOVA 1210, NOVA 1220, or NOVA 820 computer, the model numbers specified above are sufficient to ensure that the proper cable will be supplied. However, if the computer is a NOVA, SUPERNOVA®, NOVA 800, NOVA 830, NOVA 840, NOVA 1200, or NOVA 1230 computer, an additional cable must be ordered. Specify DGC part number 005-003948 for the additional cable.

Equipment Cabinets - A diskette drive unit may be mounted in any standard Data General equipment cabinet.

This page left intentionally left blank

CUT ALONG DOTTED LINE

READERS COMMENT FORM

DOCUMENT TITLE: .....

Your comments, accompanied by answers to the following questions, help us improve the quality and usefulness of our publications. If your answer to a question is "no" or requires qualification, please explain.

How did you use this publication?

( ) As an introduction to the subject.
( ) As an aid for advanced knowledge.
( ) For information about operating procedures.
( ) To instruct in a class.
( ) As a student in a class.
( ) As a reference manual.
( ) Other.....

Did you find the material:

- Useful..... YES ( ) NO ( )
- Complete..... YES ( ) NO ( )
- Accurate..... YES ( ) NO ( )
- Well organized..... YES ( ) NO ( )
- Well written..... YES ( ) NO ( )
- Well illustrated..... YES ( ) NO ( )
- Well indexed..... YES ( ) NO ( )
- Easy to read..... YES ( ) NO ( )
- Easy to understand..... YES ( ) NO ( )

We would appreciate any other comments; please label each comment as an addition, deletion, change, or error and reference page numbers where applicable.

COMMENTS

PAGE	COL	PARA	LINE	FROM	TO

From:

NAME..... TITLE.....
FIRM..... DIV. .....
ADDRESS.....
CITY..... STATE..... ZIP.....
TELEPHONE..... DATE.....

Data General Corporation
ENGINEERING PUBLICATIONS
COMMENT FORM
DG-00935

FOLD DOWN FIRST FOLD DOWN

FIRST CLASS
PERMIT NO. 26
SOUTHBORO
MASS. 01772

NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

BUSINESS REPLY MAIL

Postage will be paid by:

DataGeneral
Southboro, Massachusetts 01772

ATTENTION: Engineering Publications

FOLD UP SECOND FOLD UP

STAPLE